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TYPHUS FEVER

THE EXPERIMENTAL TRANSMISSION OF ENDEMIC TYPHUS FEVER OF THE UNITED STATES BY THE RAT FLEA XENOPSYLLA CHEOPIS

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The incidence of endemic typhus fever in the United States, especially in the cities and towns of the southeastern States, has been brought to general attention in the past few years largely by the work of Maxcy (1). Whether endemic typhus of the United States is of European origin or represents an importation of Mexican tabardillo, or whether it is indigenous to the United States, is a matter of conjecture. Endemic typhus shows certain differences from the European, or epidemic, typhus, especially differences of an epidemiological nature. Epidemic typhus has its greatest prevalence in winter; it is associated with crowding; it is most prevalent in the lower strata of society; multiple cases in households, jails, and hospitals are common; and it has been shown repeatedly to be associated with lousiness.

In direct contrast to epidemic typhus, the endemic typhus of the United States has its greatest prevalence in summer and fall; it is not associated with crowding; there is no predilection for the lower strata of society; there is no evidence of spread from man to man; and a history of louse infestation is noticeably rare. The epidemiological manifestations of epidemic typhus are explained by taking into account the habits of the known vector, the body louse, while the epidemiology of endemic typhus suggests some ectoparasite of the rat. Thus, Maxcy (1) noted that especially those persons employed in food-handling establishments are exposed to an increased risk of infection, and Rumreich (2) noted that 75 per cent of the endemic typhus cases studied by him in 1930 were associated with rat infestation. Endemic typhus is more closely associated with the place of employment than with the domicile. The epidemiological features of endemic typhus quite definitely rule out of consideration the body louse, established by Nicolle (3) as the vector of epidemic typhus; the head louse, shown by Goldberger (4) to be infectible with Mexican typhus, and the bed-bug, shown by Castaneda and Zinsser (5) to retain the typhus virus

in infectious form after intracoelomic injection. Three species of ticks have also been shown by Zinsser and Castaneda (6) to be capable of retaining typhus virus after intracoelomic injection. Following the recognition of the fact that cases diagnosed as typhus and occurring in the rural sections of the eastern States were in reality an eastern type of Rocky Mountain spotted fever (2) (7), coupled with the known urban characteristics of endemic typhus, the possible rôle of the tick in the transmission of typhus remains uncertain.

It should be noted that neither the bedbug nor the tick have been experimentally infected by feeding, nor have they been shown to transmit the infection in a manner possible in nature.

To be in agreement with the epidemiological evidence the vector of endemic typhus must be a blood-sucking parasite which will feed both upon the rat and upon man. Evidence of the importance of such a parasite would be strengthened by the recovery of the virus of endemic typhus from such parasites taken at foci where human cases of typhus have occurred recently.

Early in this year the recovery of a typhus-like virus from fleas taken from wild rats caught at typhus foci in Baltimore was reported (8). This was later confirmed by recovery of a similar virus from fleas taken at a typhus focus in Savannah, and each of these strains of virus was shown to be the virus of endemic typhus (9). The importance of these observations has been emphasized by the recovery of typhus virus from the brains of wild rats by Mooser, Castaneda, and Zinsser (10), working in Mexico City. Kemp (11) has confirmed recently our findings on the rat flea by reporting the recovery of endemic typhus virus from fleas caught at typhus foci in Texas. Shelmire and Dove (12) have reported some cases of endemic typhus which have suggested to them the possibility of the tropical rat mite (*Liponyssus bacoti*) being a vector of endemic typhus. The findings mentioned support the original hypothesis of Maxcy, based on his epidemiological observations, that a rodent reservoir of typhus exists in this country. That the rat louse may play a part in keeping the infection alive in rats is shown by the experimental transmission of Mexican typhus by this arthropod by Mooser, Castaneda, and Zinsser (13). These authors point out that this louse " * * * has, of course, no importance in transmission of the disease from rat to man, since it does not feed on human beings."

As a step in the elucidation of the manner by which the flea transmits endemic typhus, either from rat to rat or from rat to man, we have attempted experimental transmission of endemic typhus using one of the species of flea (*Xenopsylla cheopis*) incriminated by our previous work (8) (9). Preliminary reports of this work on experimental transmission have already been made (14) (15).

In the studies of experimental transmission of typhus virus by the flea, metal and glass boxes 24 inches long, 14 inches wide, and 18 inches deep have been used. The bottoms and corners were made of copper, the sides and ends being of glass. Tops were made of fine copper wire screening stretched over metal frames. A trap door was placed in each top.

White rats were used as the experimental animals.

VIRUS STRAIN FLEA X1-A

Approximately 50 fleas (*X. cheopis*, hand lens identification) were placed in glass box X1. White rats were injected with endemic typhus virus (Baltimore and Savannah flea strains (8) (9)) and placed in the same glass box. Approximately two weeks after the first infected white rat had been placed in box X1, rickettsiae were found in smears made from fleas removed from this box. Six fleas were then removed from this box, emulsified in physiological salt solution, and injected into two guinea pigs. One of these guinea pigs developed the characteristic signs of clinical endemic typhus described by Maxcy (16) for the strain of endemic typhus virus derived by him from a human case in Wilmington, North Carolina, and known as the "Wilmington" strain. This strain of virus, recovered from the fleas, was carried in guinea pigs and rabbits for three generations, and then dropped. Four guinea pigs were used in each generation; the majority of the animals in each generation developed clinical endemic typhus. Smears made from the tunica vaginalis of one of the guinea pigs in the second generation showed rickettsiae. Virus (testicular washings) from this guinea pig was used to inoculate two rabbits (2901A and 2901B). The development of agglutinins for *B. proteus* X₁₀ (type O) by these rabbits is shown in Table 1.

TABLE 1.—Agglutination of *B. proteus* X₁₀ (type O) by rabbit sera. (Rabbits inoculated with virus, flea X1-A; original source, emulsified fleas from box X1)

Rabbit	Number of weeks after inoculation	Serum dilutions							
		1:10	1:20	1:40	1:80	1:160	1:320	1:640	1:1,280
2901A.....	0	0	0	0	0	0	0	0	0
	1	0	0	0	0	0	0	0	0
	2	4	4	3	1	0	0	0	0
	3	4	4	4	3	0	0	0	0
	4	4	4	3	2	0	0	0	0
	5	4	4	3	0	0	0	0	0
	7	4	3	2	0	0	0	0	0
2901B.....	0	0	0	0	0	0	0	0	0
	1	0	0	0	0	0	0	0	0
	2	4	3	3	3	2	0	0	0
	3	4	4	2	0	0	0	0	0
	4	4	4	4	2	0	0	0	0
	15								

1 Rabbit accidentally killed.

VIRUS STRAIN FLEA X1-B

Noninfected white rats and additional infected white rats were then placed in box X1. After a residence of about two weeks in the box, one of the originally noninfected white rats (rat 2766) was removed and killed. Six fleas were removed from this rat, emulsified in physiological salt solution, and injected into two guinea pigs. Both animals developed clinical endemic typhus. This strain of virus was carried in guinea pigs and rabbits for three generations and then dropped. All guinea pigs inoculated with this virus developed clinical endemic typhus. Rickettsiae were found in smears made from the tunica vaginalis of guinea pigs infected with this virus. The development of agglutinins for *B. proteus* X₁₉ (type O) in the sera of two rabbits (3084A and 3084B) inoculated with this strain of virus is shown in Table 2.

TABLE 2.—Agglutination of *B. proteus* X₁₉ (type O) by rabbit sera. (Rabbits inoculated with virus, flea X1-B; original source, emulsified fleas from box X1)

Rabbit	Number of weeks after inoculation	Serum dilutions							
		1:10	1:20	1:40	1:80	1:160	1:320	1:640	1:1,280
3084A	0	3	1	0	0	0	0	0	0
	1	4	4	4	4	2	0	0	0
	2	4	4	4	4	1	0	0	0
	3	4	4	4	4	2	0	0	0
	4	4	4	3	0	0	0	0	0
3084B	0	0	0	0	0	0	0	0	0
	1	4	4	4	4	4	3	2	0
	2	4	4	4	4	4	3	0	0
	3	4	4	4	4	4	3	0	0
	4	4	4	4	4	2	0	0	0
	5	4	4	3	2	0	0	0	0

VIRUS STRAIN RAT X1

The brain and spleen from the originally noninfected white rat (rat 2766) taken from box X1 were removed and inoculated, separately, into guinea pigs. These animals developed clinical endemic typhus. This strain of virus was carried in guinea pigs and rabbits for seven generations and then dropped. Of the 53 guinea pigs in these seven generations, 37 developed clinical endemic typhus. Rickettsiae were found in smears made from the tunica vaginalis of guinea pigs infected with this virus. Histological examination was made of the brains from two guinea pigs from this strain of virus. One of the brains showed the lesions characteristic of endemic typhus. (See p. 2497.) The development of agglutinins for *B. proteus* X₁₉ (type O) in the sera of rabbits inoculated with this strain of virus is shown in Table 3.

TABLE 3.—Agglutination of *B. proteus* X₁₉ (type O) by rabbit sera. (Rabbits inoculated with virus, rat X1; original source, white rat 2766)

Rabbit	Number of weeks after inoculation	Serum dilutions							
		1:10	1:20	1:40	1:80	1:160	1:320	1:640	1:1,280
3055A.....	0	2	1	0	0	0	0	0	0
	1	0	0	0	0	0	0	0	0
	2	4	4	4	4	2	0	0	0
	3	4	4	4	4	2	0	0	0
	4	4	4	4	3	2	0	0	0
	5	4	4	3	0	0	0	0	0
3055B.....	0	0	0	0	0	0	0	0	0
	1	4	3	0	0	0	0	0	0
	2	4	4	3	0	0	0	0	0
	3	4	4	4	2	0	0	0	0
	4	4	4	2	0	0	0	0	0
	5	4	4	0	0	0	0	0	0
3061B.....	0	0	0	0	0	0	0	0	0
	1	4	4	4	4	4	0	0	0
	2	4	4	4	4	4	2	0	0
	3	4	4	4	4	3	0	0	0
	4	4	4	4	4	2	0	0	0
	5	4	4	4	4	3	2	0	0
	6	4	4	3	2	0	0	0	0

That guinea pigs which had recovered after injection with virus rat X1 were immune to endemic typhus is shown in Chart 1.

VIRUS STRAIN FLEA X3

The fleas remaining in box X1 were then transferred to a freshly cleaned and sterilized box, X3. White rats infected with typhus and noninfected white rats were placed in box X3. About two weeks later one of the originally noninfected white rats (2772) was killed. Fleas taken from this rat were emulsified and inoculated into guinea pigs. This resulted in the establishment of a strain of virus which has been carried for nine generations in guinea pigs and rabbits. Of 45 guinea pigs inoculated with this strain of virus, 41 have developed clinical endemic typhus.

Histological examination was made of the brains from five guinea pigs from this strain. Two of these brains showed the characteristic lesions of endemic typhus.

Rickettsiae have been found in smears made from the tunica vaginalis of guinea pigs infected with this strain of virus.

The development of agglutinins for *B. proteus* X₁₉ (type O) in the sera of rabbits following inoculation with this strain (flea X3) of virus is shown in Table 4.

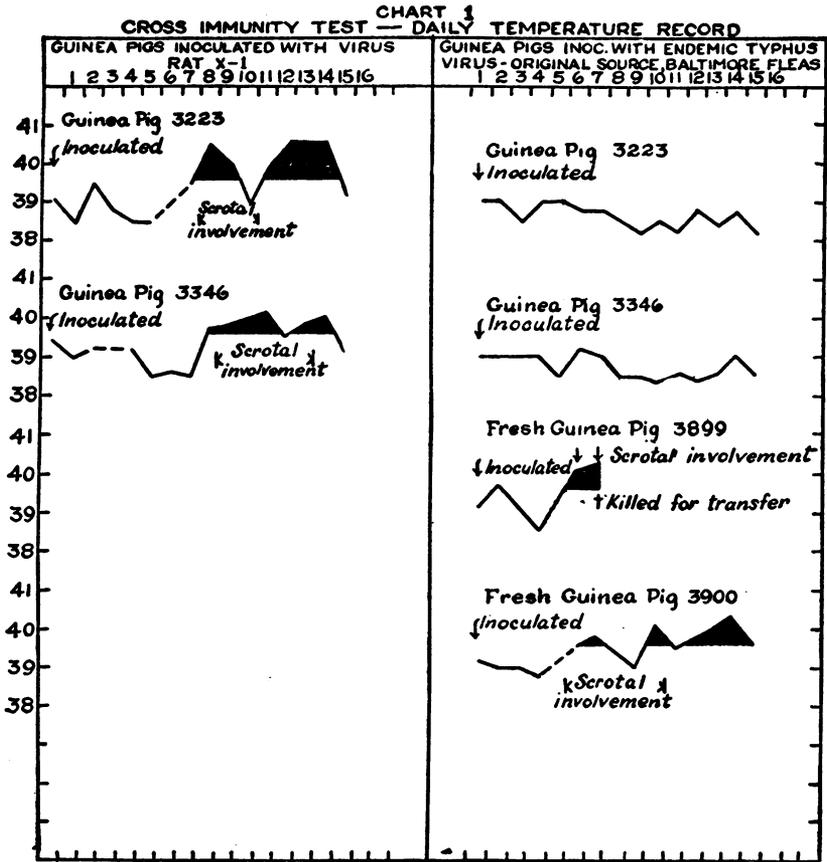


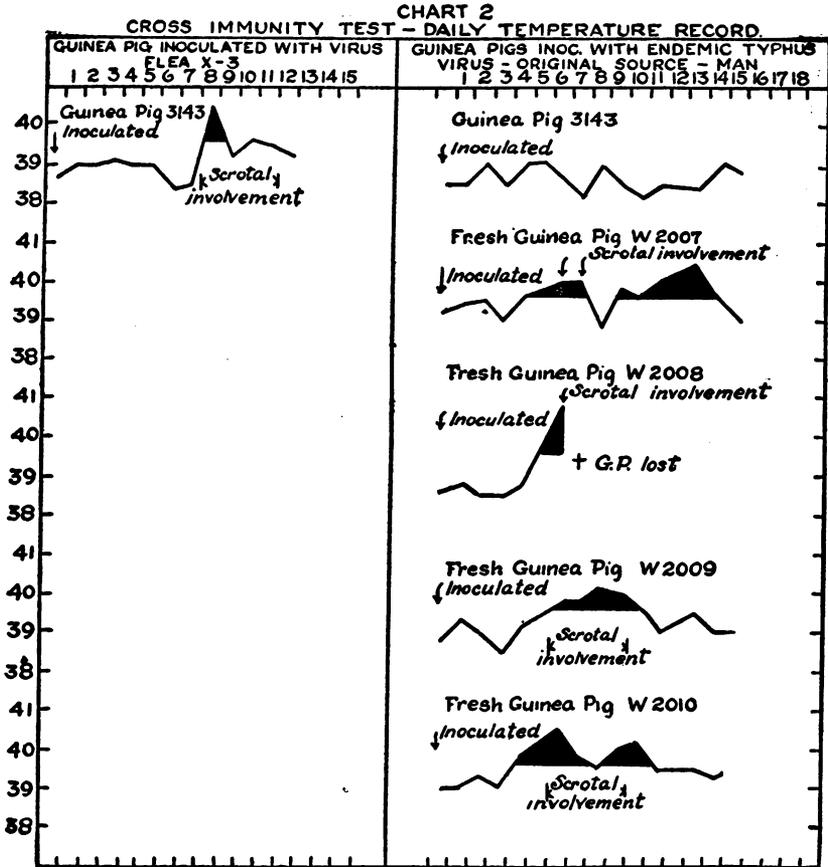
TABLE 4.—Agglutination of *B. proteus* X₁₀ (type O) by rabbit sera. (Rabbits inoculated with virus, flea X3; original source, emulsified fleas)

Rabbit	Number of weeks after inoculation	Serum dilutions							
		1:10	1:20	1:40	1:80	1:160	1:320	1:640	1:1,280
3145A.....	0	0	0	0	0	0	0	0	0
	1	0	0	0	0	0	0	0	0
	2	4	4	4	2	0	0	0	0
	3	4	4	4	2	0	0	0	0
	4	4	4	3	0	0	0	0	0
3145B.....	0	0	0	0	0	0	0	0	0
	1	3	4	4	0	0	0	0	0
	2	4	4	4	4	4	3	0	0
	3	4	4	4	4	4	3	0	0
	4	4	4	4	4	4	0	0	0
	5	4	4	4	4	4	2	0	0
6	4	4	4	4	3	0	0	0	

Cross immunity tests show clear-cut cross immunity between endemic typhus virus originally isolated from a human case and the flea X3 strain. This immunity is shown in Charts 2 and 3.

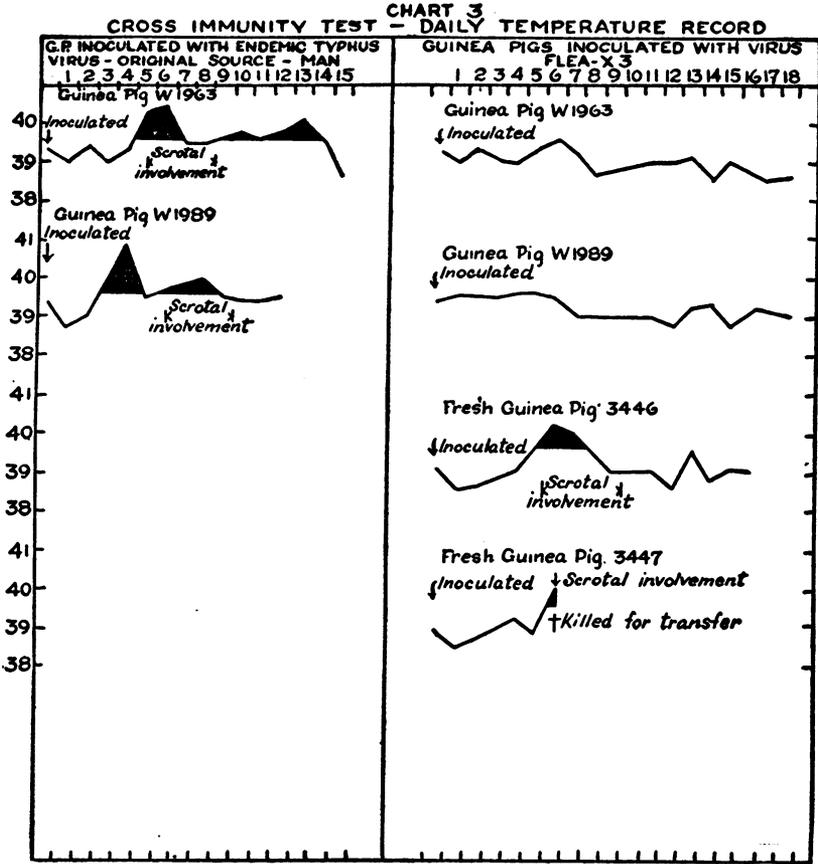
VIRUS STRAIN RAT X3-A

Brain and spleen from originally noninfected white rat 2772, from box X3, were emulsified in physiological salt solution and injected



separately into guinea pigs, four animals being inoculated. Each of these guinea pigs developed clinical endemic typhus. This strain of virus was carried in guinea pigs, rabbits, and monkeys for 10 generations. In these 10 "generations" 96 guinea pigs have been used, half of the guinea pigs being inoculated with blood and half with testicular washings. Thirty-two of those inoculated with blood and 35 of those inoculated with testicular washings have developed clinical endemic typhus.

Histological examination has been made of brain sections from 4 guinea pigs from this strain. Two of these brains showed the characteristic lesions of endemic typhus.



Rickettsiae (see photomicrograph 456) have been found in smears made from the tunica vaginalis of guinea pigs infected with this strain of virus.

The development of agglutinins for *B. proteus* X₁₀ (type O) in the sera of rabbits and monkeys following inoculation with this strain of virus (rat X3-A) is shown in Table 5.

TABLE 5.—*Agglutination of B. proteus X₁₉ (type O) by rabbit and monkey sera. (Animals inoculated with virus, rat X3-A)*

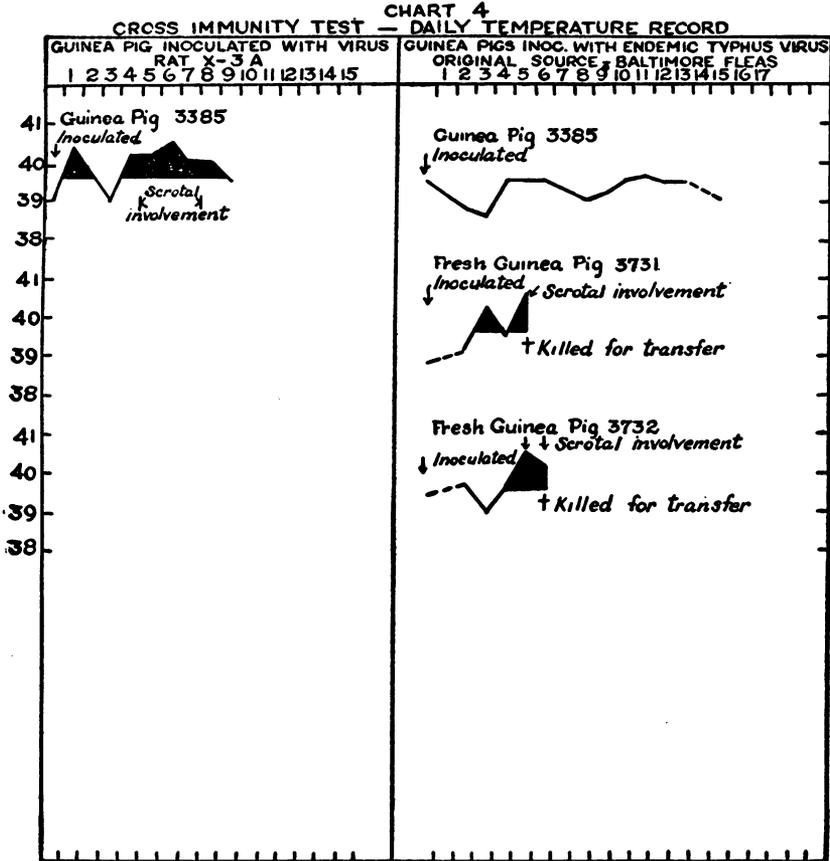
Animal	Number of weeks after inoculation	Serum dilutions							
		1:10	1:20	1:40	1:80	1:160	1:320	1:640	1:1,280
Rabbit 3078A.....	0	0	0	0	0	0	0	0	0
	1	0	0	0	0	0	0	0	0
	2	4	4	4	4	2	0	0	0
	3	4	4	4	4	3	0	0	0
	4	4	4	4	1	0	0	0	0
	5	0	2	0	0	0	0	0	0
Rabbit 3078B.....	0	0	0	0	0	0	0	0	0
	1	0	0	0	0	0	0	0	0
	2	4	4	4	4	3	2	0	0
	3	4	4	4	4	1	0	0	0
	4	4	4	4	4	3	0	0	0
	5	4	4	3	2	0	0	0	0
Rabbit 3103A.....	0	2	1	0	0	0	0	0	0
	1	4	4	4	4	2	0	0	0
	2	4	4	4	4	4	3	2	0
	3	4	4	4	4	4	2	0	0
	4	4	4	4	4	0	0	0	0
	5	4	4	3	1	0	0	0	0
Rabbit 3103B.....	0	3	2	0	0	0	0	0	0
	1	0	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0	0
	3	4	3	0	0	0	0	0	0
	4	4	3	1	0	0	0	0	0
	5	4	3	0	0	0	0	0	0
Monkey 510.....	0	4	3	0	0	0	0	0	0
	1	2	4	4	3	0	0	0	0
	2	3	4	4	4	0	0	0	0
	3	4	4	4	4	4	0	0	0
	4	3	4	4	4	1	0	0	0
Monkey 511.....	0	3	2	0	0	0	0	0	0
	1	4	4	2	0	0	0	0	0
	2	3	4	4	2	0	0	0	0
	3	4	4	4	2	0	0	0	0
	4	3	2	0	0	0	0	0	0

Charts 4 and 5 show the results of cross-immunity tests between the rat X3-A strain of virus and the strains of endemic typhus virus recovered from fleas caught at typhus foci in Baltimore and Savannah.

VIRUS STRAIN RAT X3-B

Additional white rats were inoculated with endemic typhus virus and placed in box X3. Fresh, noninfected white rat 3031 was placed in this box and allowed to remain two weeks. At the end of this period the spleen from this rat was emulsified in salt solution and injected into two guinea pigs, the brain being treated in the same

manner. One of the guinea pigs inoculated with splenic emulsion and one of those inoculated with brain, developed clinical endemic typhus. This strain of virus (rat X3-B) has been carried in guinea pigs and rabbits for 11 generations, with results similar to those described for the strain rat X3-A.



Histological examination has been made of brain sections of one guinea pig infected with this strain. This brain showed the characteristic lesions of endemic typhus. Rickettsiae have been found in smears made from the tunica vaginalis of guinea pigs infected with this strain of virus.

Table 6 shows the production of agglutinins for *B. proteus* X₁₀ (type O) in rabbits following inoculation with virus rat X3-B.

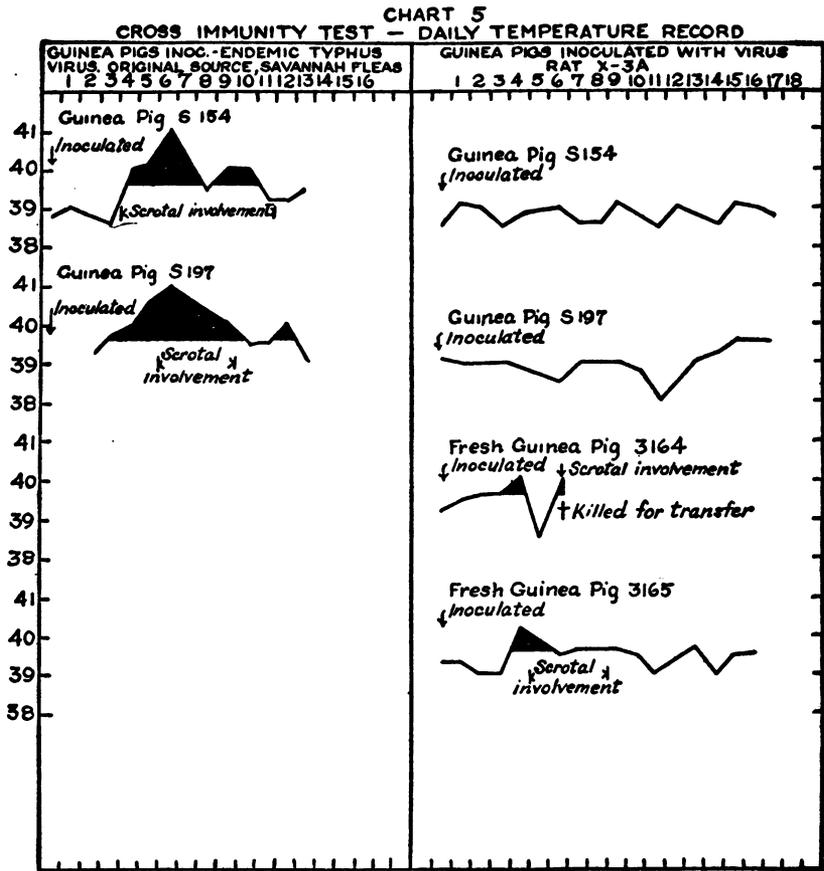
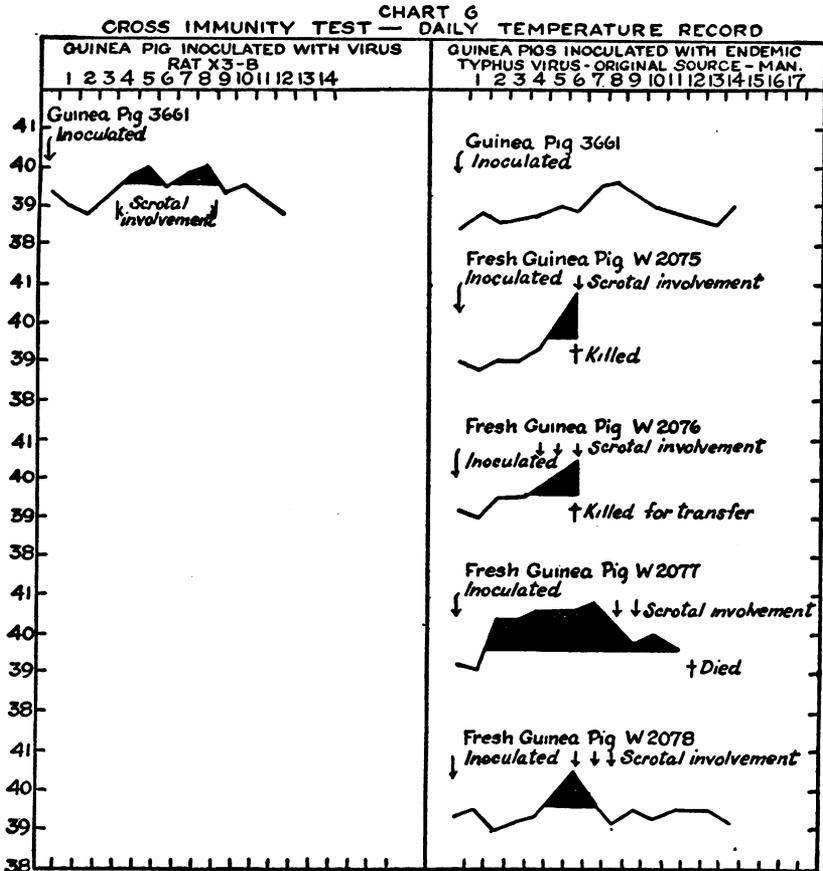


TABLE 6.—Agglutination of *B. proteus* X₁₉ (type O) by rabbit sera after inoculation of the rabbits with virus, rat X3-B

Rabbit	Number of weeks after inoculation	Serum dilutions							
		1:10	1:20	1:40	1:80	1:160	1:320	1:640	1:1,280
3197A	0	0	0	0	0	0	0	0	0
	1	4	3	2	0	0	0	0	0
	2	4	4	4	4	0	0	0	0
	3	4	3	2	0	0	0	0	0
	4	4	3	1	0	0	0	0	0
3197B	5	4	4	4	3	0	0	0	0
	0	2	0	0	0	0	0	0	0
	1	3	0	0	0	0	0	0	0
	2	4	4	1	0	0	0	0	0
	3	4	4	3	0	0	0	0	0
3197B	4	4	4	0	0	0	0	0	0
	5	3	3	0	0	0	0	0	0

Cross immunity tests between strain rat X3-B and strains of endemic typhus are shown in Charts 6 and 7.

It will be noted that originally noninfected rats 2766, 2772, and 3031, from which the strains of virus rat X1, rat X3-A, and rat X3-B were established, were exposed in the glass boxes not only to infected fleas but also to infected rats. To overcome this objection approximately 150 infected fleas were removed from box X3 and placed in freshly sterilized box X7. Three fresh white rats (3241,

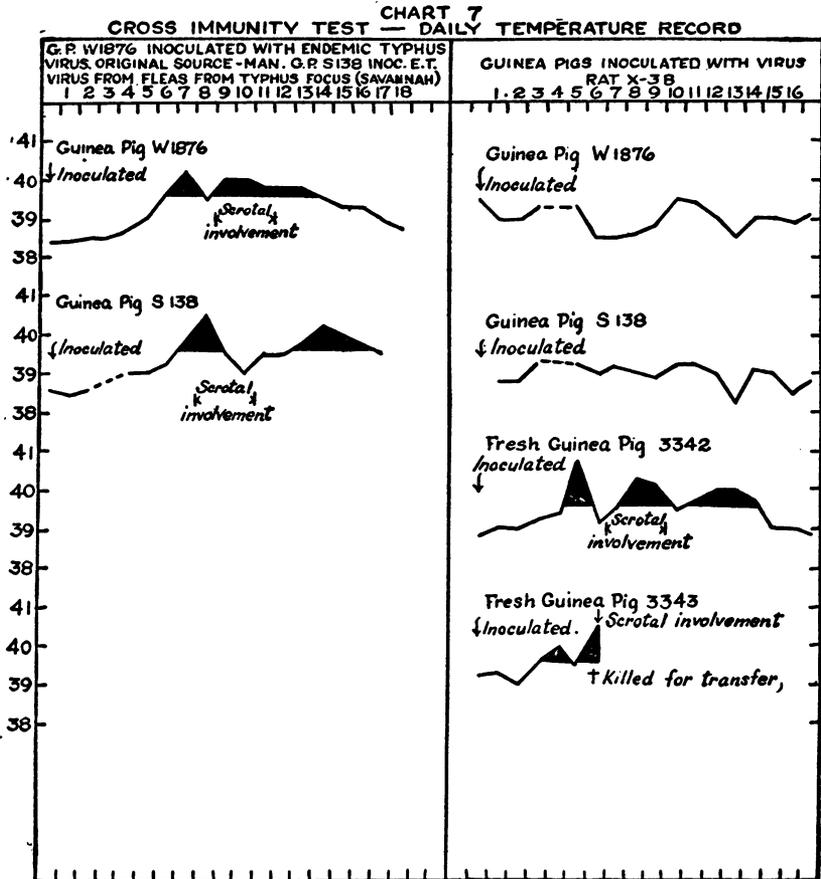


3242, and 3245) were then placed in box X7. After a residence in the box of 13, 14, and 15 days, respectively, these rats were removed and killed. Two guinea pigs were injected with the emulsified spleen from each rat, and two with the emulsified brain. From white rat 3241 a strain of clinical endemic typhus was recovered (strain rat X7-A), and also from white rat 3245 (strain rat X7-B). The guinea pigs injected with material from white rat 3240 developed febrile reactions, without scrotal involvement, in from 6 to 12 days after inoculation but were not "transferred." Four white rats from

the same lot of rats from which white rats 3241, 3242, and 3245 were chosen, were killed and guinea pigs injected with brain and spleen emulsions. None of these guinea pigs developed clinical endemic typhus.

VIRUS STRAIN RAT X7-A

This strain of virus has been carried in guinea pigs and rabbits for seven generations. Of 40 guinea pigs inoculated with this virus, 31 have developed clinical endemic typhus.



Rickettsiae have been found in smears made from the tunica vaginalis of guinea pigs infected with this strain of virus (see photomicrograph 458).

Brains from five guinea pigs from this strain were examined histologically. One of these showed scanty lesions of endemic typhus, one was frankly negative, and three were doubtful.

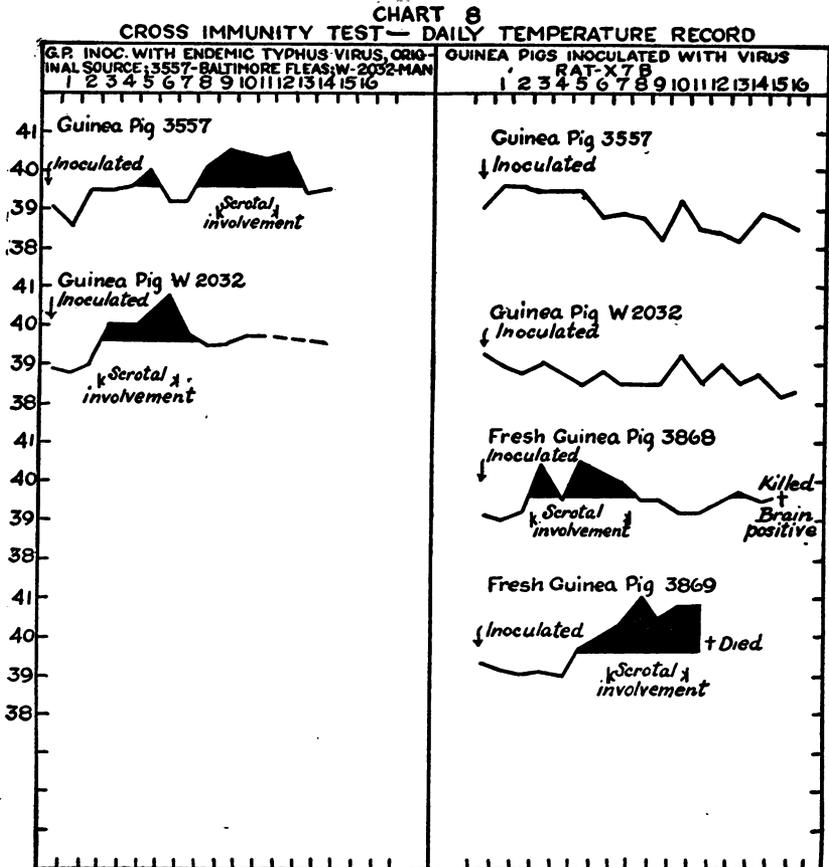
Table 7 shows the production of agglutinins for *B. proteus* X₁₀ (type O) in rabbits following inoculation with virus rat X7-A.

TABLE 7.—Agglutination of *B. proteus* X₁₀ (type O) by rabbit sera after inoculation of the rabbits with virus, rat X7-A

Rabbit	Number of weeks after inoculation	Serum dilutions							
		1:10	1:20	1:40	1:80	1:160	1:320	1:640	1:1,280
3870A.....	0	3	2	0	0	0	0	0	0
	1	0	0	0	0	0	0	0	0
	2	4	4	4	4	2	0	0	0
	3	4	4	4	4	3	0	0	0
3870B.....	0	2	0	0	0	0	0	0	0
	1	0	0	0	0	0	0	0	0
	2	4	4	4	4	2	0	0	0
	3	4	4	4	4	2	0	0	0

VIRUS STRAIN RAT X7-B

This strain of virus has been carried in guinea pigs, monkeys, and rabbits for seven generations. Of the 60 guinea pigs used, 52 have



developed clinical endemic typhus. Rickettsiae have been found in smears made from the tunica vaginalis of guinea pigs infected with this virus.

The brains from three guinea pigs infected with this strain of virus have been examined histologically. Two of these showed the lesions characteristic of endemic typhus.

Table 8 shows the production of agglutinins for *B. proteus* X₁₉ (type O) in monkeys and rabbits subsequent to their inoculation with virus rat X7-B.

TABLE 8.—*Agglutination of B. proteus* X₁₉ (type O), by monkey and rabbit sera after inoculation with virus, rat X7-B

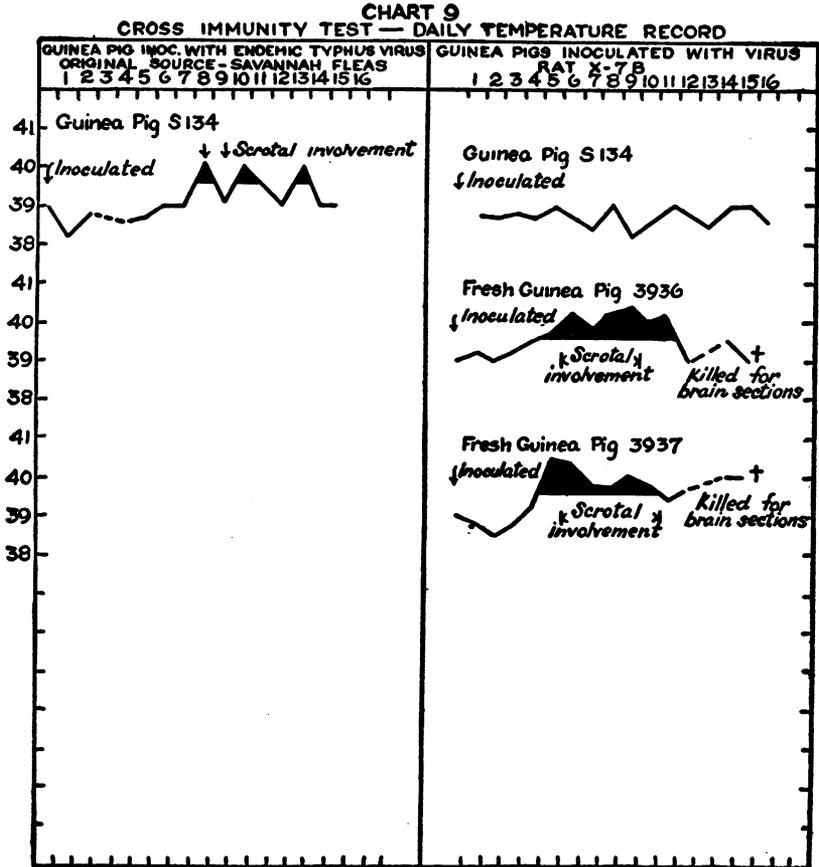
Animal	Number of weeks after inoculation	Serum dilutions							
		1:10	1:20	1:40	1:80	1:160	1:320	1:640	1:1,280
Monkey 512.....	0	2	2	0	0	0	0	0	0
	1	4	4	2	0	0	0	0	0
	2	2	3	4	4	3	1	0	0
	3	2	3	3	4	4	3	2	0
	4	4	4	4	4	4	2	0	0
	5	4	4	4	4	4	2	0	0
6	4	4	2	0	0	0	0	0	
Monkey 515.....	0	3	0	0	0	0	0	0	0
	1	0	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0	0
	3	2	3	4	4	4	4	3	2
	4	2	3	4	4	4	4	4	2
	5	3	4	4	4	4	4	2	0
6	3	4	4	3	1	0	0	0	
Rabbit 3428A.....	0	2	0	0	0	0	0	0	0
	1	4	4	3	1	0	0	0	0
	2	4	4	4	4	2	0	0	0
	3	4	4	4	4	2	0	0	0
4	4	3	2	2	0	0	0	0	
Rabbit 3428B.....	0	3	0	0	0	0	0	0	0
	1	4	2	0	0	0	0	0	0
	2	4	4	4	4	4	3	2	0
	3	4	4	4	4	4	3	0	0
4	4	4	4	4	3	1	0	0	
Rabbit 3507A.....	0	0	0	0	0	0	0	0	0
	1	3	3	0	0	0	0	0	0
	2	4	4	4	4	4	4	0	0
	3	4	3	2	0	0	0	0	0
	4	4	4	3	0	0	0	0	0
5	4	4	2	0	0	0	0	0	
Rabbit 3507B.....	0	2	1	0	0	0	0	0	0
	1	4	4	4	4	3	3	0	0
	2	4	4	4	4	4	4	2	0
	3	4	4	4	4	2	0	0	0
	4	4	4	4	4	2	0	0	0
5	4	4	4	2	0	0	0	0	

The results of the cross immunity tests completed to date between virus strain rat X7-B and endemic typhus virus are shown in Charts 8 and 9.

The experiment detailed above for box X7 was repeated with box X11. Three originally noninfected rats were placed in box X11 with infected fleas. After two weeks in this box the rats were killed, fleas removed, and injected into guinea pigs. The brains and spleens from each of the rats were emulsified and injected separately into guinea pigs. From the guinea pigs injected with fleas and from

those injected with material from each rat, viruses were established which produced clinical endemic typhus in guinea pigs.

Rickettsiae have been found in guinea pigs infected with both the strain recovered from the fleas (see photomicrograph 454) and the strains established from the rat organs. Agglutinins for *B. proteus*



X₁₉ (type O) have been produced in rabbits infected with one of the strains derived from these rats. (See Table 9.)

TABLE 9.—Agglutination of *B. proteus* X₁₉ (type O), by rabbit sera after inoculation with virus, rat X11

Rabbit	Number of weeks after inoculation	Serum dilutions							
		1:10	1:20	1:40	1:80	1:160	1:320	1:640	1:1,280
3940A.....	0	0	0	0	0	0	0	0	0
	1	4	4	3	1	0	0	0	0
	2	4	4	4	4	4	3	0	0
3940B.....	0	4	2	0	0	0	0	0	0
	1	4	3	0	0	0	0	0	0
	2	4	4	4	3	0	0	0	0

It should be noted that routine blood cultures were made from all guinea pigs at the time material was taken for transfer. These cultures have been negative in the great majority of instances.

Repeated examination of the rats and the glass boxes used to house the experimental rats has failed to show the presence of any blood-sucking parasite other than the rat flea (*X. cheopis*).

Additional experimental work has shown that the typhus virus is present in the flea for at least nine days after feeding on infected rats. Typhus virus also has been recovered repeatedly from the feces of infected fleas.

BRAIN PATHOLOGY IN GUINEA PIGS

The lesions in endemic typhus are of the same general type as in European, or epidemic, typhus in guinea pigs, but are much less plentiful than in either the Wolbach or Breinl strains of European typhus. They consist of the well known small compact cellular glioses such as are seen in human and experimental epidemic (European) typhus and of various types of vascular reactions within the brain substance and of usually scanty, irregular, often perivascular cellular infiltrations in the pia, consisting chiefly of lymphocytes, rarely also macrophages, and sometimes associated with edema or fibroblast proliferation. The most frequent vascular lesion is an infiltration of the vessel sheath by lymphocytes, less often adventitia cell proliferation or perivascular hemorrhage are seen, rarely endothelial swelling or proliferation. Definite thrombosis or endothelial necrosis were not observed except for a single lesion in one of 20 guinea pigs infected with Maxcy's "H" strain (16). Lymphocyte infiltration of variable extent and density was seen in the chorioid plexi of one "H" strain animal, and of four guinea pigs of the Baltimore flea strain.

TABLE 10.—*Frequency, type, and distribution of brain lesions in guinea pigs (counted in 5 to 6 complete cross sections of the brain from the frontal, mid-parietal, mid-brain, cerebellopontine, and medullary levels)*

Strain	Maxcy "H" strain human, 1927	Experi- mental strains, rat and flea X-series	Baltimore and Savannah flea strains	"Wilmington" strain	European Breinl strain ¹ (for com- parison)
Total number of brains tabulated.....	20	24	19	40	1
Number showing meningeal reaction.....	(?)	21	18	(?)	1
Number showing focal glioses.....	(?)	12	7	18	1
Number showing intracerebral vascular lesions.....	(?)	11	6	15	1
Number showing lesions of both types.....	(?)	9	4	11	1
Number showing intracerebral lesions of either type.....	11	14	10	23	1
Total number of focal glioses recorded in all.....	(?)	48	37	(?)	76
Total number of vascular lesions recorded in all.....	(?)	28	35	(?)	101
Total number of both types in all.....	58	76	72	(?)	177
Cerebral cortex:					
Glioses.....	(?)	28	15	(?)	33
Vessels.....	(?)	10	11	(?)	36
Total.....	32	38	26	(?)	69

¹ No scrotal involvement.

² Not recorded.

³ Not recorded except in 4.

TABLE 10.—Frequency, type, and distribution of brain lesions in guinea pigs (counted in 5 to 6 complete cross sections of the brain from the frontal, mid-parietal, mid-brain, cerebellopontine, and medullary levels)—Continued

Strain	Maxcy "H" strain human, 1927	Experimental strains, rat and flea X-series	Baltimore and Savannah flea strains	"Wilmington" strain	European Breinl strain ¹ (for comparison)
Basal ganglia:					
Glioses.....	(?)	0	4	(?)	9
Vessels.....	(?)	1	6	(?)	14
Total.....	8	1	10	(?)	23
Thalamus:					
Glioses.....	(?)	6	2	(?)	19
Vessels.....	(?)	2	2	(?)	27
Total.....	(?)	8	4	(?)	46
Mid-brain:					
Glioses.....	(?)	4	7	(?)	6
Vessels.....	(?)	2	4	(?)	6
Total.....	5	6	11	(?)	12
Cerebellum:					
Glioses.....	(?)	3	6	(?)	6
Vessels.....	(?)	3	4	(?)	14
Total.....	3	6	10	(?)	20
Pons:					
Glioses.....	(?)	2	2	(?)	3
Vessels.....	(?)	4	1	(?)	4
Total.....	9	6	3	(?)	7
Medulla:					
Glioses.....	(?)	5	1	(?)	0
Vessels.....	(?)	6	7	(?)	0
Total.....	1	11	8	(?)	0

¹ No scrotal involvement.

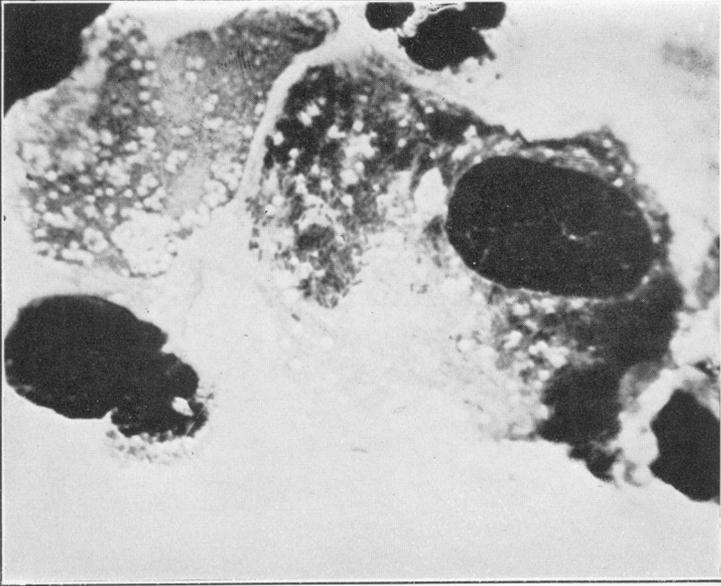
² Not recorded.

The distribution and types of lesions in four strain groups of endemic typhus and proportion of brains showing such lesions are tabulated in Table 10. Similar data for a single guinea pig infected with the Breinl strain of European typhus are placed in this table for contrast as to the number of lesions present. The number of lesions counted in this brain, on comparable sections, is more than equal to the sum of those seen in each of three of the other groups. In regard to the topographic distribution, lesions were found to be most numerous in the cerebral cortex. A similar distribution has been noted in the Wolbach and Breinl strains of European typhus (unpublished data).

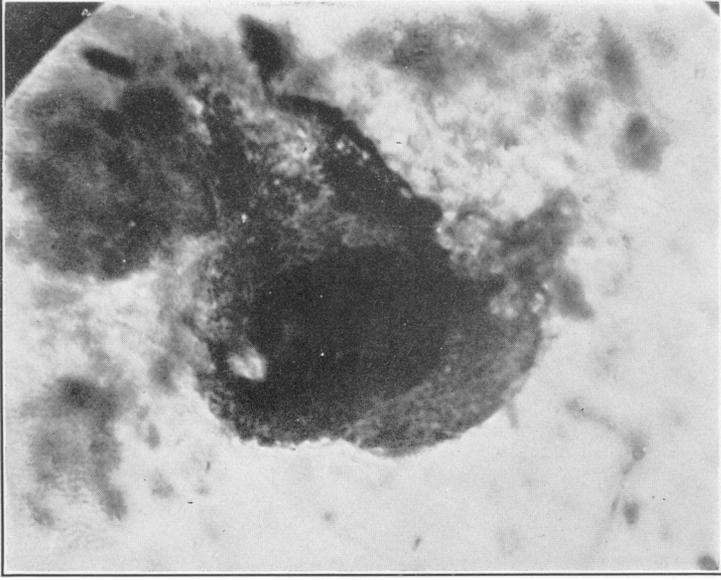
It should be noted that with one or two exceptions all of the guinea pigs included in Table 10 showed scrotal involvement, typical of endemic typhus, during the course of the disease.

SUMMARY

In conclusion it may be stated that the rat flea (*Xenopsylla cheopis*) as a vector of endemic typhus meets the requirements of the epidemiological evidence. The virus of endemic typhus has been recov-



PHOTOMICROGRAPH (NO. 458) SHOWING MANY RICKETT-
SIAE IN CELL CYTOPLASM (X 1,430)



PHOTOMICROGRAPH (NO. 454) SHOWING CELL CYTO-
PLASM PACKED WITH RICKETTISIAE (X 1,430)



PHOTOMICROGRAPH (NO. 456) SHOWING RUPTURED
CELL WITH INCLUDED AND FREE RICKETTSIAE

ered repeatedly (four times by us; once by Kemp) from rat fleas taken at typhus foci, and, finally, experimental transmission of the virus from rat to rat by means of the rat flea (*X. cheopis*) has been carried out in the laboratory.

The foregoing evidence points to the rat flea (*X. cheopis*) as a common vector of endemic typhus from rat to rat and from rat to man.

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SICKNESS AMONG MALE INDUSTRIAL EMPLOYEES IN THE SECOND QUARTER OF 1931

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The sickness incidence rate among a sample group of male wage earners, based on reports to the Public Health Service from industrial sick-benefit associations, was lower in the second quarter of 1931 than in the same quarter of 1930, which rate in turn was lower than that of the second quarter of 1929. The decrease in the frequency of sickness, exclusive of accidents, was 12 per cent from the 1930 to the 1931 period under consideration, and 11 per cent from 1929 to 1930. Thus two decreases virtually of the same magnitude have occurred since 1929.

These results were obtained from reports covering the same industrial establishments in 1931 as in 1930, and in 1929 from 23 of the 27 establishments reporting in the two most recent years. The population under observation in each of the three periods, and especially in the last two years was, therefore, much the same. The number of men included in the record was approximately 152,000 in 1931, 166,000 in 1930, and 164,000 in 1929.

The cases included were those which caused disability for eight consecutive calendar days or longer and for which sick benefits were paid. In the group of mutual-benefit associations under consideration all diseases are compensable with the exception of the venereal diseases, and in a few of the associations certain chronic pathological conditions contracted prior to the date of joining the organization.

The record applies to employed males only, but includes those working on part time. For persons indefinitely laid off, membership in the benefit association ordinarily is automatically terminated.

TABLE 1.—*Frequency of disability lasting eight calendar days or longer in the second quarter of 1931 compared with the same quarter of 1930 and 1929*

[Male morbidity experience of 27 industrial establishments which reported their cases to the United States Public Health Service during all three years¹]

Diseases and disease groups which caused disability (numbers in parentheses are disease title numbers from the International List of Causes of Death, third revision, Paris, 1920)	Annual number of disabilities per 1,000 men in—		
	1931	1930	1929
Sickness and nonindustrial injuries ²	85.2	94.9	104.8
Nonindustrial injuries.....	12.0	11.7	11.7
Sickness ²	73.2	83.2	93.1
Respiratory diseases.....	25.3	31.4	35.7
Influenza, grippe (11).....	9.7	12.0	12.2
Bronchitis, acute and chronic (99).....	2.9	4.1	4.8
Pneumonia, all forms (100, 101).....	1.9	2.4	3.2
Diseases of the pharynx and tonsils (109).....	5.8	6.8	8.7
Tuberculosis of the respiratory system (31).....	1.2	1.7	1.4
Other respiratory diseases (97, 98, 102-107).....	3.8	4.4	5.4
Nonrespiratory diseases.....	47.9	51.8	57.4
Diseases of the stomach—cancer excepted (111, 112).....	3.5	4.5	5.3
Diarrhea and enteritis (114).....	.9	1.3	1.3
Appendicitis (117).....	3.6	4.8	5.4
Hernia (118a).....	1.9	1.4	2.1
Other digestive diseases (108, 110, 115, 116, 118b-127).....	2.7	3.0	3.3
Rheumatic group, total.....	10.5	11.5	12.4
Rheumatism, acute and chronic (51, 52).....	6.0	5.9	6.6
Diseases of the organs of locomotion (158).....	3.0	3.6	3.8
Neuralgia, neuritis, sciatica (82).....	1.5	2.0	2.3
Neurasthenia (part of 84).....	1.5	1.3	1.4
Other diseases of the nervous system (70-81, 83, part of 84).....	1.5	1.0	1.1
Diseases of the heart and arteries, and nephritis (87-92, 96, 128, 129).....	3.7	3.4	4.2
Other genito-urinary diseases (130-136).....	2.4	2.3	2.3
Diseases of the skin (151-154).....	3.1	3.8	4.3
Epidemic and endemic diseases except influenza (1-10, 12-25).....	2.9	3.7	3.2
Ill-defined and unknown causes (205).....	2.1	2.1	2.6
All other diseases ² (26-30, 32-37, 41-50, 53-69, 85, 86, 93-95, 155-157, 159, 164).....	7.6	7.7	8.5
Average number of males covered in the record.....	151, 813	165, 791	164, 108

¹ Except that the rates for 1929 cover 23 of the 27 establishments included in 1930 and 1931.

² Exclusive of disability from the venereal diseases.

Virtually all disease groups participated in the decline in incidence. Diseases of the respiratory system as a whole decreased 19 per cent in the second quarter of 1931 as compared with the same quarter of

1930, and 29 per cent when compared with the rate during the corresponding period of 1929. The reported frequency of influenza decreased about 20 per cent as compared with the same period of either of the two preceding years. The incidence of pneumonia (all forms) was lower by 21 per cent than in the second quarter of 1930, and by 41 per cent than in the same period of 1929. Decreases of similar magnitude were recorded for bronchitis, and for tonsillitis and other diseases of the tonsils and pharynx. Even for tuberculosis of the respiratory system the indicated frequency of new cases was lower in the 1931 period than in either of the two preceding second quarters. For all other respiratory diseases combined, the decrease was 14 per cent from the 1930 incidence and 30 per cent from that in 1929.

The rate for total nonrespiratory diseases, which seldom fluctuates to any marked extent, was 8 per cent lower in 1931 than in 1930 and 17 per cent below the 1929 frequency. Diseases showing the most marked decreases in this group include diseases of the stomach (exclusive of cancer), appendicitis, diseases of the skin, and the rheumatic group (rheumatism—acute and chronic, lumbago and other diseases of the organs of locomotion, and neuralgia, neuritis, sciatica).

For three disability categories, however, the 1931 rates were definitely above those of each of the two preceding periods. In one of these three groups, namely, nonindustrial injuries, a higher rate this year is to be expected, because, as fewer hours are spent in the factory, the time during which men are exposed to accidents outside the workshop, obviously, is increased. The other two disability categories showing increased incidence were (a) neurasthenia and (b) certain other diseases of the nervous system.

In the report for the first quarter of 1931 it was stated that the frequency of illnesses reported as neurasthenia was higher in 1921 than in any year since then, and that in view of the similarity of industrial conditions in 1921 and 1931 it appeared worth while to present the rates for this disease separately in Table 1.¹ The neurasthenia rate was not as high during the second quarter of this year as in 1921 (an annual rate of 1.5 cases per 1,000 men as compared with 2.5 in 1921), but it was somewhat higher than in the second quarter of 1930 and of 1929. (See Table 1.) For certain other diseases of the nervous system the increase this year was larger than that shown for neurasthenia. The incidence of this group was 1.5 in 1931, as compared with 1.0 in 1930, and 1.1 in 1929. Included in this group are the more serious mental cases, paresis, cerebral embolism, cerebral hemorrhage, meningitis, encephalitis, and certain other diseases of the nervous system (title numbers 70-81 and 83 in the International

¹ Cf. *Sickness among Male Industrial Employees in the first quarter of 1931*. Pub. Health Rep., vol. 46, No. 31 (July, 1931).

List of the Causes of Death, third revision, Paris, 1920). Unfortunately, the population under observation was not large enough to afford statistics of the trend of these diseases separately.

Although the morbidity rates presented cover a very small sample of the male wage-earning population of the country, they are consistent with certain other health indexes. For example, the Metropolitan Life Insurance Co. reports that the death rate among its approximately 19,000,000 industrial life-insurance policyholders in the United States and Canada was 8.9 per 1,000 in the second quarter of 1931, which was slightly better than the low for the second quarter of any preceding year (9.0 in 1921).² The company also reports a sharp drop in the mortality from tuberculosis during the second quarter in spite of severe unemployment, which usually tends to increase the tuberculosis death rate.³

COURT DECISION RELATING TO PUBLIC HEALTH

Conviction for sale of adulterated article reversed where statute made such sale compulsory.—(California Superior Court, Appellate Dept.; *People v. Wolin*, 2 P. (2d) 60; decided Aug. 3, 1931.) A statute made it unlawful to "sell or offer for sale, or keep for sale," any adulterated drug and so defined "drug" as to include fluid extract of ginger. It was also provided by the statute that any agent of the State board of health should have the right to purchase any drug suspected of being adulterated or to take samples thereof if a sale was refused, and refusal to sell such a sample to an agent was made a misdemeanor.

The defendant was convicted under a complaint which charged that he did "sell and offer for sale and hold out for sale and offer to deliver" adulterated fluid extract of ginger. The sale proved was one made to an agent of the State board of health, who announced his authority to the defendant and stated that he wished to take officially a sample of the ginger. The defendant thereupon delivered to the agent four bottles of the ginger for which the agent paid the defendant. On appeal by the defendant, the appellate court pointed out that there was no such offense as "holding out for sale" nor (except in case of imported drugs, which was not the charge in the instant case) any such offense as "offering to deliver." It stated that the conviction had to rest for support, therefore, on the charge of selling and offering for sale, but went on to say that no offer was shown by the evidence. The conviction for such sale was reversed because the court did not regard the transaction as violative of the statute. "We can not ascribe to the legislature," said the court,

² Statistical Bulletin, Metropolitan Life Insurance Co., vol. 12, No. 7 (July, 1931), p. 7.

³ *Ibid.*, p. 8.

"an intention to punish as a crime an act the refusal to do which is also made criminal; and yet an affirmation of this conviction must rest on such a construction of the statute."

DEATHS DURING WEEK ENDED SEPTEMBER 26, 1931

Summary of information received by telegraph from industrial insurance companies for the week ended September 26, 1931, and corresponding week of 1930. (From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce)

	Week ended September 26, 1931	Corresponding week, 1930
Policies in force.....	74, 796, 694	75, 495, 053
Number of death claims.....	13, 063	12, 170
Death claims per 1,000 policies in force, annual rate.....	9. 1	8. 4
Death claims per 1,000 policies, first 39 weeks of year, annual rate.....	9. 8	9. 7

Deaths ¹ from all causes in certain large cities of the United States during the week ended September 26, 1931, infant mortality, annual death rate, and comparison with corresponding week of 1930. (From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce)

[The rates published in this summary are based upon mid-year population estimates derived from the 1930 census]

City	Week ended Sept. 26, 1931				Corresponding week, 1930		Death rate ² for the first 39 weeks	
	Total deaths	Death rate ²	Deaths under 1 year	Infant mortality rate ³	Death rate ²	Deaths under 1 year	1931	1930
Total (62 cities).....	6, 701	9. 8	668	4 53	10. 5	791	12. 1	12. 0
Akron.....	34	6. 9	7	69	8. 2	4	7. 8	7. 9
Albany ⁴	32	12. 9	5	99	16. 3	2	13. 9	15. 0
Atlanta.....	72	13. 5	4	41	12. 1	6	15. 2	15. 8
White.....	39		2	32		6		
Colored.....	33	(⁵)	2	57	(⁵)	0	(⁵)	(⁵)
Baltimore ⁴	190	12. 2	18	61	11. 5	28	14. 6	14. 1
White.....	131		12	52		21		
Colored.....	59	(⁵)	6	94	(⁵)	7	(⁵)	(⁵)
Birmingham.....	46	8. 9	8	80	12. 4	7	13. 7	13. 8
White.....	17		4	69		3		
Colored.....	29	(⁵)	4	97	(⁵)	4	(⁵)	(⁵)
Boston.....	201	13. 3	25	71	12. 0	23	14. 3	14. 2
Bridgeport.....	29	10. 3	4	66	8. 5	4	11. 3	11. 1
Buffalo.....	111	10. 0	13	53	11. 1	14	13. 2	13. 1
Cambridge.....	19	8. 7	5	101	9. 2	3	12. 2	11. 7
Camden.....	33	14. 5	7	122	13. 2	1	14. 5	13. 7
Canton.....	11	5. 4	1	23	8. 4	4	10. 2	10. 1
Chicago ⁴	559	8. 4	61	54	10. 2	64	10. 8	10. 5
Cincinnati.....	118	13. 5	10	60	17. 1	12	16. 2	15. 7
Cleveland.....	173	9. 9	14	41	9. 5	23	11. 3	11. 2
Columbus.....	48	8. 5	6	59	13. 8	9	13. 8	15. 7
Dallas.....	39	7. 5	5		8. 9	10	11. 3	11. 6
White.....	26		2			9		
Colored.....	13	(⁵)	3		(⁵)	1	(⁵)	(⁵)
Dayton.....	45	11. 3	3	42	12. 9	6	11. 9	10. 6
Denver.....	62	11. 1	9	87	13. 9	13	14. 0	14. 9
Des Moines.....	29	10. 5	4	70	8. 8	6	11. 2	11. 8
Detroit.....	211	6. 7	35	56	7. 2	33	8. 4	9. 4
Duluth.....	25	12. 8	2	49	13. 4	2	11. 4	11. 3
El Paso.....	21	10. 4	3		13. 7	6	16. 0	17. 6
Erie.....	14	6. 2	2	37	7. 6	3	10. 7	11. 3
Fall River ^{5 7}	12	5. 4	3	68	12. 2	8	11. 3	12. 1
Flint.....	16	5. 1	6	77	11. 6	11	7. 0	9. 8

Footnotes at end of table.

Deaths¹ from all causes in certain large cities of the United States during the week ended September 26, 1931, infant mortality, annual death rate, and comparison with corresponding week of 1930—Continued

[The rates published in this summary are based upon mid-year population estimates derived from the 1930 census]

City	Week ended Sept. 26, 1931				Corresponding week, 1930		Death rate ² for the first 39 weeks	
	Total deaths	Death rate ³	Deaths under 1 year	Infant mortality rate ⁴	Death rate ³	Deaths under 1 year	1931	1930
Fort Worth	29	9.0	4		9.2	1	10.9	11.1
White	26		4			1		
Colored	3	(⁵)	0		(⁵)	0	(⁵)	(⁵)
Grand Rapids	26	7.9	0	0	11.4	4	9.2	10.4
Houston	67	11.3	6		11.8	12	11.3	12.2
White	49		6			7		
Colored	18	(⁵)	0		(⁵)	5	(⁵)	(⁵)
Indianapolis	75	10.6	7	58	16.1	16	14.0	14.8
White	67		6	56		13		
Colored	8	(⁵)	1	67	(⁵)	3	(⁵)	(⁵)
Jersey City	51	8.3	1	9	7.4	4	11.7	11.3
Kansas City, Kans.	33	14.0	5	103	14.5	2	12.8	11.7
White	25		5	123		1		
Colored	8	(⁵)	0	0	(⁵)	1	(⁵)	(⁵)
Kansas City, Mo.	91	11.6	4	30	12.6	9	13.3	13.3
Knoxville	42	20.1	4	85	7.3	4	12.7	13.8
White	33		4	95		4		
Colored	9	(⁵)	0	0	(⁵)	0	(⁵)	(⁵)
Long Beach	29	9.9	2	48	6.9	4	9.8	9.9
Los Angeles	266	10.5	17	49	10.1	23	10.8	11.1
Louisville	89	15.1	11	94	11.3	6	14.5	13.7
White	69		10	98		4		
Colored	20	(⁵)	1	66	(⁵)	2	(⁵)	(⁵)
Lowell?	22	11.4	2	51	10.9	2	12.7	13.4
Lynn	17	8.6	1	26	4.6	0	9.7	10.5
Memphis	65	13.1	6	63	10.3	8	16.7	17.4
White	29		2	33		4		
Colored	36	(⁵)	4	116	(⁵)	4	(⁵)	(⁵)
Miami	32	14.8	6	152	8.0	0	11.9	11.2
White	22		3	106		0		
Colored	10	(⁵)	3	265	(⁵)	0	(⁵)	(⁵)
Milwaukee	83	7.3	12	52	9.1	11	9.4	9.7
Minneapolis	70	7.7	5	32	9.7	5	11.4	10.7
Nashville	50	16.8	15	223	16.9	6	17.1	16.7
White	33		9	179		4		
Colored	17	(⁵)	6	354	(⁵)	2	(⁵)	(⁵)
New Bedford?	19	8.8	1	27	12.5	5	12.1	10.9
New Haven	26	8.3	1	19	3.2	0	12.4	12.3
New Orleans	141	15.7	8	44	16.3	16	17.1	17.5
White	79		7	58		10		
Colored	62	(⁵)	1	16	(⁵)	6	(⁵)	(⁵)
New York	1,134	8.3	95	40	8.9	117	11.3	10.9
Bronx Borough	169	6.6	14	32	7.0	11	8.3	8.0
Brooklyn Borough	389	7.7	41	43	7.9	38	10.4	10.0
Manhattan Borough	420	12.1	26	44	13.3	51	17.2	16.2
Queens Borough	122	5.5	14	38	6.0	14	7.3	7.1
Richmond Borough	34	10.8	0	0	10.8	3	14.0	14.4
Newark, N. J.	80	9.4	11	58	10.1	11	11.8	12.1
Oakland	67	12.0	4	51	9.9	1	10.5	11.0
Oklahoma City	33	8.7	3	41	14.2	12	11.0	10.9
Omaha	37	8.9	2	22	8.3	5	14.0	13.6
Paterson	21	7.9	5	86	9.8	2	13.4	12.3
Peoria	26	12.5	4	105	11.4	2	12.7	12.6
Philadelphia	410	10.9	40	58	11.4	61	13.3	12.7
Pittsburgh	151	11.6	25	86	13.8	13	14.7	13.9
Portland, Oreg.	55	9.3	2	24	8.4	5	11.6	12.1
Providence	56	11.5	8	74	9.5	5	12.9	13.1
Richmond	44	12.4	2	29	11.1	4	15.8	15.0
White	25		1	22		2		
Colored	19	(⁵)	1	43	(⁵)	2	(⁵)	(⁵)
Rochester	65	10.2	2	18	10.8	4	12.0	11.6
St. Louis	193	12.2	17	57	12.9	25	15.5	14.3
St. Paul	45	8.5	2	21	7.7	4	10.8	10.1
Salt Lake City ¹	35	12.8	2	30	5.6	0	12.3	12.3
San Antonio	29	6.3	2		10.5	8	14.6	16.9
San Diego	26	8.7	4	81	13.9	1	13.6	14.5
San Francisco	148	11.9	9	60	13.5	8	13.1	13.1
Schenectady	18	9.8	5	29	10.9	1	10.6	11.4

Footnotes at end of table.

Deaths¹ from all causes in certain large cities of the United States during the week ended September 26, 1931, infant mortality, annual death rate, and comparison with corresponding week of 1930—Continued

[The rates published in this summary are based upon mid-year population estimates derived from the 1930 census]

City	Week ended Sept. 26, 1931				Corresponding week, 1930		Death rate ² for the first 39 weeks	
	Total deaths	Death rate ³	Deaths under 1 year	Infant mortality rate ⁴	Death rate ⁵	Deaths under 1 year	1931	1930
Seattle.....	64	9.0	1	9	8.2	4	11.4	10.9
Somerville.....	14	6.9	1	37	7.5	1	9.1	9.8
South Bend.....	19	9.2	3	75	7.5	3	8.1	8.9
Spokane.....	36	16.1	1	26	10.8	1	12.5	12.3
Springfield, Mass.....	24	8.2	2	31	11.4	1	11.8	12.2
Syracuse.....	36	8.8	4	47	8.9	5	11.7	11.6
Tacoma.....	27	13.1	3	77	9.3	0	12.1	12.5
Toledo.....	50	8.8	1	9	13.2	2	12.0	12.7
Trenton.....	28	11.8	4	70	12.2	6	16.7	16.7
Utica.....	30	15.3	5	130	12.3	3	14.1	14.9
Washington, D. C.....	118	12.5	16	89	13.6	16	15.9	15.2
White.....	63		6	49		3		
Colored.....	55	(⁶)	10	172	(⁶)	13	(⁶)	(⁶)
Waterbury.....	17	8.8	1	30	7.3	1	9.8	9.8
Wilmington, Del. ⁷	15	7.3	1	22	19.1	5	14.1	14.5
Worcester.....	27	7.1	1	14	9.3	2	12.1	12.9
Yonkers.....	18	6.8	0	0	6.2	0	8.7	8.1
Youngstown.....	32	9.7	5	70	10.7	7	10.3	10.3

¹ Deaths of nonresidents are included. Stillbirths are excluded.

² These rates represent annual rates per 1,000 population, as estimated for 1931 and 1930 by the arithmetical method.

³ Deaths under 1 year of age per 1,000 live births. Cities left blank are not in the registration area for births.

⁴ Data for 77 cities.

⁵ Deaths for week ended Friday.

⁶ For the cities for which deaths are shown by color, the percentage of colored population in 1920 was as follows: Atlanta, 31; Baltimore, 15; Birmingham, 39; Dallas, 15; Fort Worth, 14; Houston, 25; Indianapolis, 11; Kansas City, Kans., 14; Knoxville, 15; Louisville, 17; Memphis, 38; Miami, 31; Nashville, 30; New Orleans, 26; Richmond, 32; and Washington, D. C., 25.

⁷ Population Apr. 1, 1930; decreased 1920 to 1930, no estimate made.

PREVALENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

CURRENT WEEKLY STATE REPORTS

These reports are preliminary, and the figures are subject to change when later returns are received by the State health officers

Reports for Weeks Ended October 3, 1931, and October 4, 1930

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended October 3, 1931, and October 4, 1930

Division and State	Diphtheria		Influenza		Measles		Meningococcus meningitis	
	Week ended Oct. 3, 1931	Week ended Oct. 4, 1930	Week ended Oct. 3, 1931	Week ended Oct. 4, 1930	Week ended Oct. 3, 1931	Week ended Oct. 4, 1930	Week ended Oct. 3, 1931	Week ended Oct. 4, 1930
New England States:								
Maine.....	3	2		1	31	8	0	0
New Hampshire.....	3	1			2		0	0
Vermont.....					9	1	0	0
Massachusetts.....	36	38	5	1	22	54	1	5
Rhode Island.....	8	4			4		2	1
Connecticut.....	2	7	3	8	2	2	0	2
Middle Atlantic States:								
New York.....	53	60	10	13	41	41	5	8
New Jersey.....	22	79	5	1	1	25	2	2
Pennsylvania.....	83	121			84	49	7	5
East North Central States:								
Ohio.....	116	48	2	2	22	12	0	3
Indiana.....	20	63	6	16	3	5	2	5
Illinois.....	70	118	1	18	15	34	4	9
Michigan.....	17	49	1		17	11	8	0
Wisconsin.....	8	1	12	10	16	36	1	3
West North Central States:								
Minnesota.....	21	17		1	4	1	2	3
Iowa.....	10	3			3		0	1
Missouri.....	49	30		1		24	1	3
North Dakota.....	5	3				18	1	0
South Dakota.....	13	5			8	1	0	0
Nebraska.....	14	10	1		2		0	2
Kansas.....	19	9			2	3	0	2
South Atlantic States:								
Delaware.....	3	1	3			4	0	0
Maryland ¹	40	11	2	1	1	4	0	0
District of Columbia.....	11	9				3	0	0
Virginia.....								
West Virginia ²	58	21	13	5	23	17	0	0
North Carolina.....	130	129	9	5	8	5	0	1
South Carolina.....	32	38	188	187	5		0	0
Georgia ³	61	22	9	20	6	23	0	1
Florida.....	16	4			17	2	0	0
East South Central States:								
Kentucky.....	144	28					1	7
Tennessee.....	103	36	13	2	2	7	1	0
Alabama ⁴	116	43		22	8	22	1	1
Mississippi.....	146	40					0	1
West South Central States:								
Arkansas.....	47	3		5	1	1	0	0
Louisiana.....	32	24		4		3	1	0
Oklahoma ⁴	70	41	1	8	1	8	0	0
Texas ¹	28	41	3	11	1	2	1	0
Mountain States:								
Montana.....	2	4			17		0	0
Idaho.....	6	1				7	0	0
Wyoming.....	1	1					0	0
Colorado.....	7	5			4	65	0	2
New Mexico.....	8	5		2	1		1	2
Arizona.....	3	6	3	2	2	12	0	1
Utah ²	2		6	5	1	1	1	4
Pacific States:								
Washington.....	5	12			7	11	2	1
Oregon.....	2		18	15	4	45	0	1
California.....	43	39	15	31	54	67	4	1

¹ New York City only.

² Week ended Friday.

³ Typhus fever, 1931, 13 cases: 1 case in West Virginia; 1 case in Georgia; 6 cases in Alabama; and 5 cases in Texas.

⁴ Figures for 1931 are exclusive of Oklahoma City and Tulsa.

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended October 3, 1931, and October 4, 1930—Continued

Division and State	Pollomyelitis		Scarlet fever		Smallpox		Typhoid fever	
	Week ended Oct. 3, 1931	Week ended Oct. 4, 1930	Week ended Oct. 3, 1931	Week ended Oct. 4, 1930	Week ended Oct. 3, 1931	Week ended Oct. 4, 1930	Week ended Oct. 3, 1931	Week ended Oct. 4, 1930
New England States:								
Maine.....	8	9	16	12	0	0	8	8
New Hampshire.....	22	1	10	0	0	0	0	2
Vermont.....	9	1	10	0	3	0	0	0
Massachusetts.....	112	38	103	67	0	0	4	8
Rhode Island.....	4	2	5	4	0	0	4	1
Connecticut.....	64	10	11	16	0	0	4	4
Middle Atlantic States:								
New York.....	275	50	104	100	0	0	39	86
New Jersey.....	52	3	44	47	0	0	20	12
Pennsylvania.....	50	15	167	151	0	0	93	43
East North Central States:								
Ohio.....	11	75	196	162	4	36	59	95
Indiana.....	6	17	35	72	7	18	18	20
Illinois.....	51	23	80	108	5	7	29	38
Michigan.....	112	20	69	90	1	2	16	27
Wisconsin.....	47	14	21	54	1	4	4	7
West North Central States:								
Minnesota.....	56	17	44	28	1	19	2	0
Iowa.....	13	25	14	36	11	12	3	4
Missouri.....	5	18	38	28	0	0	16	25
North Dakota.....	3	3	4	7	5	6	4	6
South Dakota.....	0	14	7	3	1	6	1	2
Nebraska.....	1	60	8	13	2	5	1	3
Kansas.....	0	87	35	38	0	2	14	11
South Atlantic States:								
Delaware.....	1	0	1	0	0	0	2	3
Maryland ¹	6	2	33	24	0	0	33	35
District of Columbia.....	4	0	6	4	0	0	0	4
Virginia.....	2							
West Virginia ²	11	1	38	48	2	0	81	70
North Carolina.....	4	1	88	86	0	0	29	21
South Carolina.....	2	2	6	19	0	0	36	41
Georgia ³	0	3	17	27	1	0	27	32
Florida.....	3	2	4	2	0	1	3	1
East South Central States:								
Kentucky.....	1	2	62	51	0	0	102	40
Tennessee.....	2	1	39	49	34	0	82	55
Alabama ⁴	0	4	30	39	2	0	30	31
Mississippi.....	0	0	26	18	4	1	31	19
West South Central States:								
Arkansas.....	1	11	20	10	2	0	13	21
Louisiana.....	0	7	16	15	1	1	59	28
Oklahoma ⁴	1	6	26	49	4	3	58	35
Texas ⁵	1	8	14	24	0	17	53	20
Mountain States:								
Montana.....	4	2	4	13	0	0	4	8
Idaho.....	0	0	13	1	7	0	11	3
Wyoming.....	1	12	0	6	0	0	1	0
Colorado.....	0	5	14	16	0	3	9	8
New Mexico.....	1	2	1	6	0	0	13	14
Arizona.....	0	3	4	10	0	0	8	1
Utah ²	0	0	3	11	0	0	0	7
Pacific States:								
Washington.....	5	3	28	33	0	22	4	11
Oregon.....	0	2	11	16	3	0	3	0
California.....	4	68	79	73	4	10	18	14

¹ Week ended Friday.

² Typhoid fever, 1931, 13 cases: 1 case in West Virginia; 1 case in Georgia; 6 cases in Alabama; and 5 cases in Texas.

⁴ Figures for 1931 are exclusive of Oklahoma City and Tulsa.

SUMMARY OF MONTHLY REPORTS FROM STATES

The following summary of cases reported monthly by States is published weekly and covers only those States from which reports are received during the current week.

State	Me-ningo-coccus menin-gitis	Diph-theria	Infu-enza	Ma-laria	Me-as-les	Pel-lagra	Pollo-mye-litis	Scarlet fever	Small-pox	Ty-phoid fever
<i>August, 1931</i>										
Massachusetts.....	7	132	8	-----	179	3	433	290	0	35
Nevada.....	-----	-----	1	-----	-----	-----	0	-----	0	0
South Dakota.....	2	19	2	-----	6	-----	2	17	3	8
Wisconsin.....	-----	44	42	-----	151	-----	173	61	4	13
<i>September, 1931</i>										
District of Columbia	3	35	3	-----	3	-----	4	23	0	11
Georgia.....	3	162	44	214	13	41	9	71	0	201
Nebraska.....	3	33	2	-----	4	-----	12	26	4	9
Tennessee.....	8	273	38	285	13	27	18	150	10	290

<i>August, 1931</i>		Cases
Anthrax:		
Massachusetts.....		2
Chicken pox:		
Massachusetts.....		112
Nevada.....		1
South Dakota.....		29
Wisconsin.....		112
Dysentery:		
Massachusetts.....		3
German measles:		
Massachusetts.....		38
Wisconsin.....		13
Hook worm disease:		
Massachusetts.....		1
Lead poisoning:		
Massachusetts.....		1
Lethargic encephalitis:		
Massachusetts.....		4
Wisconsin.....		2
Mumps:		
Massachusetts.....		185
South Dakota.....		15
Wisconsin.....		216
Ophthalmia neonatorum:		
Massachusetts.....		126
South Dakota.....		1
Wisconsin.....		3
Septic sore throat:		
Massachusetts.....		25
Trachoma:		
Massachusetts.....		3
South Dakota.....		4
Tularæmia:		
Nevada.....		2
Undulant fever:		
Massachusetts.....		2
South Dakota.....		1
Wisconsin.....		5
Whooping cough:		
Massachusetts.....		557
Nevada.....		10
South Dakota.....		23
Wisconsin.....		600
<i>September, 1931</i>		
Anthrax:		
Nebraska.....		1

Chicken pox:		
District of Columbia.....		1
Georgia.....		7
Nebraska.....		6
Tennessee.....		17
Dengue:		
Georgia.....		4
Dysentery:		
Georgia.....		11
Tennessee.....		10
Impetigo contagiosa:		
Tennessee.....		11
Lethargic encephalitis:		
Georgia.....		1
Nebraska.....		1
Tennessee.....		3
Mumps:		
Georgia.....		11
Nebraska.....		16
Tennessee.....		11
Paratyphoid fever:		
Georgia.....		2
Tennessee.....		3
Puerperal septicæmia:		
Tennessee.....		1
Rabies in man:		
Georgia.....		1
Rocky Mountain spotted or tick fever:		
District of Columbia.....		1
Tennessee.....		1
Septic sore throat:		
Georgia.....		38
Nebraska.....		2
Tennessee.....		24
Tetanus:		
Tennessee.....		1
Trachoma:		
Tennessee.....		4
Typhus fever:		
Georgia.....		16
Undulant fever:		
Georgia.....		3
Whooping cough:		
District of Columbia.....		89
Georgia.....		17
Nebraska.....		30
Tennessee.....		79

**Cases of Certain Communicable Diseases Reported for the Month of April, 1931,
by State Health Officers**

State	Chick- en pox	Dipha- theria	Measles	Mumps	Scarlet fever	Small- pox	Tuber- culosis	Ty- phoid and para- typhoid fever	Whoop- ing cough
Maine.....	133	17	114	162	109	0	44	8	222
New Hampshire.....	79	8	13	98	12	0	20	2	97
Vermont.....	1,007	182	2,200	767	1,586	0	456	12	615
Massachusetts.....	71	25	178	393	314	0	56	3	42
Rhode Island.....	346	33	2,914	292	231	0	146	5	266
Connecticut.....	2,902	476	10,483	2,029	3,982	16	1,744	50	2,066
New York.....	1,786	218	3,843	299	1,341	0	478	12	833
New Jersey.....	3,355	360	17,932	2,211	2,413	1	597	44	896
Pennsylvania.....	2,146	194	3,504	2,511	1,989	288	766	22	391
Ohio.....	316	107	4,267	85	1,165	436	228	13	309
Indiana.....	1,532	494	7,259	1,312	2,296	245	707	27	735
Illinois.....	1,235	143	4,466	694	1,502	96	642	15	855
Michigan.....	1,590	51	2,806	3,773	626	28	144	6	445
Wisconsin.....	735	50	466	369	25	288	5	177	
Minnesota.....	334	26	271	154	367	314	28	1	91
Iowa.....	317	121	2,036	157	1,407	213	251	7	160
Missouri.....	117	19	233	104	84	31	20	6	44
North Dakota.....	134	34	476	14	129	104	26	1	44
South Dakota.....	352	37	24	628	144	139	14	1	78
Nebraska.....	398	43	223	605	251	466	110	10	233
Kansas.....	25	7	1,036	122	158	0	25	1	8
Delaware.....	466	52	5,981	365	307	0	274	15	132
Maryland.....	107	60	1,325	105	0	0	99	1	31
District of Columbia.....	711	66	3,449	162	22	22	23	344	
Virginia.....	236	39	324	188	14	59	21	367	
West Virginia.....	556	91	3,805	176	6	6	11	740	
North Carolina.....	375	70	566	157	33	13	122	17	219
South Carolina.....	241	22	471	127	315	25	99	7	57
Georgia.....	273	28	1,040	42	23	4	49	16	121
Florida.....	283	38	1,409	143	383	103	157	32	143
Kentucky ¹	155	65	1,611	185	101	56	411	19	93
Tennessee.....	950	25	372	457	80	308	157	29	372
Mississippi.....	223	21	192	147	111	144	58	23	106
Arkansas.....	57	76	19	3	88	150	130	31	25
Louisiana.....	185	55	83	41	143	306	58	19	45
Oklahoma ²	99	99			171			21	
Texas.....	227	10	93	111	139	14	82	5	135
Montana.....	11	14	20	47	67	13	10	12	239
Idaho.....	109	3	10	82	52	12	* 1	0	24
Wyoming.....	348	25	790	243	138	12	77	3	285
Colorado.....	172	8	232	96	27	7	46	9	105
New Mexico.....	38	12	178	26	17	5	98	7	47
Arizona.....	13	2	89	11	4	0	* 7	0	28
Utah ¹	527	30	413	273	177	180	168	15	562
Nevada.....	232	20	548	308	53	110	56	5	60
Washington.....	2,734	326	7,354	1,597	772	239	1,166	57	1,778
Oregon.....									
California.....									

¹ Reports received weekly.² Pulmonary.³ Exclusive of Oklahoma City and Tulsa.

Case Rates per 100,000 Population (Annual Basis) for the Month of April, 1931

State	Chick- en pox	Diph- theria	Measles	Mumps	Scarlet fever	Small- pox	Tuber- culosis	Ty- phoid and para- typhoid fever	Whoop- ing cough
Maine.....	202	26	173	246	166	0	67	12	337
New Hampshire.....	21	3			31			5	
Vermont.....	267	2	44	331	101	7	68	0	327
Massachusetts.....	225	52	623	217	449	0	129	3	174
Rhode Island.....	124	44	310	685	548	0	98	5	73
Connecticut.....	258	25	2,169	217	172	0	109	4	198
New York.....	275	45	992	192	377	2	165	5	196
New Jersey.....	524	64	1,127	85	393	0	140	4	244
Pennsylvania.....	419	45	2,239	276	301	0	75	5	112
Ohio.....	387	35	631	452	358	52	138	4	70
Indiana.....	117	40	1,585	32	433	162	85	5	115
Illinois.....	240	77	1,137	205	360	38	111	4	115
Michigan.....	301	35	114	169	367	23	157	4	209
Wisconsin.....	650	21	1,147	1,544	256	11	59	2	182
Minnesota.....	346	24	219		174	12	136	2	83
Iowa.....	164	13	133	76	180	154	14	0	45
Missouri.....	105	40	677	52	468	71	84	2	53
North Dakota.....	208	34	414	155	149	55	36	11	78
South Dakota.....	233	59	828	24	224	181	45	2	77
Nebraska.....	309	32	21	551	126	122	12	1	68
Kansas.....	256	28	143	389	161	299	71	6	150
Delaware.....	127	35	5,246	618	800	0	127	5	41
Maryland.....	343	38	4,400	269	226	0	202	11	97
District of Columbia.....	264	148	3,271		259	0	244	2	77
Virginia.....	355	33	1,723		81	11		11	172
West Virginia.....	163	27	224		130	10	41	15	253
North Carolina.....	208	34	1,427		66	2		4	277
South Carolina.....	261	49	395	109	23	9	85	12	163
Georgia.....	101	9	197	53	132	10	41	3	24
Florida.....	217	22	827	33	18	3	39	13	96
Kentucky ¹									
Tennessee.....	121	17	647	66	176	47	72	15	66
Alabama.....	70	29	731	84	46	25	186	9	42
Mississippi.....	568	15	222	273	48	184	94	17	222
Arkansas.....	145	14	125	96	72	94	² 18	15	69
Louisiana.....	32	43	11	2	50	85	² 74	18	14
Oklahoma ³	107	32	48	24	83	178	34	11	26
Texas.....		20			35			4	
Montana.....	514	23	210	251	315	32	186	11	306
Idaho.....	30	38	54	128	183	35	27	33	814
Wyoming.....	578	16	53	435	276	64	² 5	0	127
Colorado.....	404	29	918	282	160	14	89	3	331
New Mexico.....	486	23	655	271	76	20	130	25	296
Arizona.....	103	33	483	71	46	14	266	19	128
Utah ¹									
Nevada.....	171	26	1,168	144	52	0	² 92	0	367
Washington.....	404	23	316	209	136	138	129	11	430
Oregon.....	290	25	684	385	66	137	70	6	75
California.....	559	67	1,503	326	158	49	234	12	362

¹ Reports received weekly.
² Pulmonary.
³ Exclusive of Oklahoma City and Tulsa.

GENERAL CURRENT SUMMARY AND WEEKLY REPORTS FROM CITIES

The 98 cities reporting cases used in the following table are situated in all parts of the country and have an estimated aggregate population of more than 33,480,000. The estimated population of the 91 cities reporting deaths is more than 31,935,000. The estimated expectancy is based on the experience of the last nine years, excluding epidemics.

Weeks ended September 26, 1931, and September 27, 1930

	1931	1930	Esti- mated expect- ancy
<i>Cases reported</i>			
Diphtheria:			
46 States.....	1,482	1,058	
98 cities.....	291	355	520
Measles:			
45 States.....	461	446	
98 cities.....	98	113	
Meningococcus meningitis:			
46 States.....	65	66	
98 cities.....	20	25	
Poliomyelitis:			
46 States.....	1,095	596	
Scarlet fever:			
46 States.....	1,422	1,511	
98 cities.....	368	447	381
Smallpox:			
46 States.....	75	140	
98 cities.....	3	20	9
Typhoid fever:			
46 States.....	1,158	976	
98 cities.....	133	109	141
<i>Deaths reported</i>			
Influenza and pneumonia:			
91 cities.....	330	357	
Smallpox:			
91 cities.....	0	0	

City reports for week ended September 26, 1931

The "estimated expectancy" given for diphtheria, poliomyelitis, scarlet fever, smallpox, and typhoid fever is the result of an attempt to ascertain from previous occurrence the number of cases of the disease under consideration that may be expected to occur during a certain week in the absence of epidemics. It is based on reports to the Public Health Service during the past nine years. It is in most instances the median number of cases reported in the corresponding weeks of the preceding years. When the reports include several epidemics, or when for other reasons the median is unsatisfactory, the epidemic periods are excluded, and the estimated expectancy is the mean number of cases reported for the week during non-epidemic years.

If the reports have not been received for the full nine years, data are used for as many years as possible, but no year earlier than 1922 is included. In obtaining the estimated expectancy, the figures are smoothed when necessary to avoid abrupt deviation from the usual trend. For some of the diseases given in the table the available data were not sufficient to make it practicable to compute the estimated expectancy.

Division, State, and city	Chicken pox, cases reported	Diphtheria		Influenza		Measles, cases reported	Mumps, cases reported	Pneumonia, deaths reported
		Cases, estimated expectancy	Cases reported	Cases reported	Deaths reported			
NEW ENGLAND								
Maine:								
Portland.....	0	0	1		0	0	2	0
New Hampshire:								
Concord.....	0	0	0		0	0	0	0
Nashua.....	0	0	0		0	0	0	0
Vermont:								
Barre.....	0	0	0		0	0	0	0
Burlington.....	0	0	0		0	0	0	0
Massachusetts:								
Boston.....	6	15	13	3	0	5	4	14
Fall River.....	0	2	1		0	3	0	0
Springfield.....	0	2	0		0	0	4	0
Worcester.....	1	3	1		0	0	8	0
Rhode Island:								
Pawtucket.....	0	0	0		0	0	0	1
Providence.....	0	3	0		0	5	3	2
Connecticut:								
Bridgeport.....	0	3	0		0	0	0	7
Hartford.....	0	2	0		0	0	1	3
New Haven.....	1	1	0		0	0	0	1

City reports for week ended September 26, 1931—Continued

Division, State, and city	Chicken pox, cases reported	Diphtheria		Influenza		Measles, cases reported	Mumps, cases reported	Pneumonia, deaths reported
		Cases, estimated expectancy	Cases reported	Cases reported	Deaths reported			
MIDDLE ATLANTIC								
New York:								
Buffalo.....	1	8	3	-----	0	1	1	8
New York.....	15	81	38	-----	2	6	13	67
Rochester.....	1	2	0	-----	0	0	0	1
Syracuse.....	0	1	0	-----	0	0	0	2
New Jersey:								
Camden.....	0	2	2	-----	0	0	0	4
Newark.....	1	9	0	-----	1	1	1	-----
Trenton.....	0	1	0	-----	0	2	2	4
Pennsylvania:								
Philadelphia.....	7	32	4	-----	1	3	8	17
Pittsburgh.....	6	11	9	-----	1	8	4	21
Reading.....	0	1	0	-----	0	0	0	0
EAST NORTH CENTRAL								
Ohio:								
Cincinnati.....	4	5	7	-----	0	0	0	6
Cleveland.....	8	27	3	-----	2	6	20	6
Columbus.....	0	3	13	-----	1	0	1	3
Toledo.....	5	4	0	-----	0	1	0	0
Indiana:								
Fort Wayne.....	0	1	5	-----	0	0	0	0
Indianapolis.....	4	6	1	-----	0	0	9	2
South Bend.....	0	0	1	-----	0	0	0	0
Terre Haute.....	1	0	1	-----	0	0	0	0
Illinois:								
Chicago.....	9	58	29	-----	3	2	15	25
Springfield.....	0	0	0	-----	0	3	1	4
Michigan:								
Detroit.....	6	33	7	-----	1	1	4	11
Flint.....	3	2	0	-----	0	0	1	0
Grand Rapids.....	0	1	0	-----	0	0	1	0
Wisconsin:								
Kenosha.....	0	1	0	-----	0	0	5	0
Madison.....	1	0	2	-----	0	0	5	-----
Milwaukee.....	8	5	2	-----	0	0	14	5
Racine.....	1	1	0	-----	0	0	3	0
Superior.....	0	0	0	-----	0	1	0	0
WEST NORTH CENTRAL								
Minnesota:								
Duluth.....	3	0	0	-----	0	0	1	0
Minneapolis.....	10	17	3	-----	0	2	17	2
St. Paul.....	3	8	2	-----	0	0	11	0
Iowa:								
Davenport.....	0	1	0	-----	-----	1	0	-----
Des Moines.....	0	1	1	-----	-----	0	0	-----
Sioux City.....	1	1	3	-----	-----	0	0	-----
Waterloo.....	3	1	3	-----	-----	0	0	-----
Missouri:								
Kansas City.....	1	3	5	-----	0	0	0	6
St. Joseph.....	0	1	3	-----	0	0	0	0
St. Louis.....	1	20	11	-----	-----	0	0	4
North Dakota:								
Fargo.....	0	0	0	-----	0	0	0	0
Grand Forks.....	0	0	0	-----	-----	0	0	-----
South Dakota:								
Aberdeen.....	7	0	0	-----	-----	4	0	-----
Sioux Falls.....	0	0	0	-----	-----	0	0	-----
Nebraska:								
Omaha.....	0	7	7	-----	0	0	1	3
Kansas:								
Topeka.....	1	1	0	-----	0	0	2	0
Wichita.....	4	1	0	-----	0	0	0	0
SOUTH ATLANTIC								
Delaware:								
Wilmington.....	0	0	0	-----	0	0	1	1
Maryland:								
Baltimore.....	4	15	9	-----	3	0	2	6
Cumberland.....	0	0	0	-----	0	0	0	0
Frederick.....	0	0	0	-----	0	0	0	1

City reports for week ended September 26, 1931—Continued

Division, State, and city	Chicken pox, cases reported	Diphtheria		Influenza		Measles, cases reported	Mumps, cases reported	Pneumonia, deaths reported
		Cases, estimated expectancy	Cases reported	Cases reported	Deaths reported			
SOUTH ATLANTIC—continued								
District of Columbia:								
Washington.....	0	10	9	2	0	1	0	7
Virginia:								
Lynchburg.....	0	2	0	-----	0	0	0	0
Norfolk.....	0	1	0	-----	0	0	0	1
Richmond.....	0	14	1	-----	0	0	0	1
Roanoke.....	0	3	1	-----	0	0	0	1
West Virginia:								
Charleston.....	0	0	2	1	1	0	0	0
Wheeling.....	0	0	0	-----	0	0	0	1
North Carolina:								
Raleigh.....	0	3	1	-----	0	0	0	1
Wilmington.....	0	0	2	-----	0	0	0	0
Winston-Salem.....	0	3	5	-----	0	1	2	1
South Carolina:								
Charleston.....	0	0	0	5	0	0	0	1
Columbia.....	0	1	0	-----	0	0	0	2
Greenville.....	0	1	1	-----	0	0	0	0
Georgia:								
Atlanta.....	0	7	3	1	1	0	0	0
Brunswick.....	0	0	0	-----	0	0	0	0
Savannah.....	0	0	1	2	0	1	2	3
Florida:								
Miami.....	0	2	0	-----	0	0	1	1
Tampa.....	0	1	0	-----	0	0	0	0
EAST SOUTH CENTRAL								
Kentucky:								
Covington.....	0	0	0	-----	0	0	0	0
Tennessee:								
Memphis.....	0	3	7	-----	0	0	0	0
Nashville.....	0	2	2	-----	0	0	0	0
Alabama:								
Birmingham.....	0	3	4	-----	0	0	0	4
Mobile.....	0	0	2	-----	1	0	0	1
Montgomery.....	0	2	7	-----	0	0	0	-----
WEST SOUTH CENTRAL								
Arkansas:								
Fort Smith.....	0	0	1	-----	0	0	0	-----
Little Rock.....	0	0	1	-----	0	1	0	2
Louisiana:								
New Orleans.....	0	8	13	-----	0	0	0	5
Shreveport.....	0	0	1	-----	0	0	0	0
Oklahoma:								
Muskogee.....	0	1	3	-----	0	0	0	0
Oklahoma City.....	0	2	3	-----	0	0	0	2
Tulsa.....	0	2	16	-----	0	1	0	-----
Texas:								
Dallas.....	0	8	6	-----	0	0	0	1
Fort Worth.....	0	1	1	-----	0	0	0	3
Galveston.....	0	0	0	-----	0	0	0	2
Houston.....	0	5	6	-----	0	0	0	4
San Antonio.....	0	2	2	-----	0	0	0	1
MOUNTAIN								
Montana:								
Billings.....	0	0	0	-----	0	1	0	0
Great Falls.....	1	0	0	-----	0	1	0	1
Helena.....	0	0	0	-----	0	1	0	0
Missoula.....	1	0	0	-----	0	0	0	0
Idaho:								
Boise.....	0	0	0	-----	0	0	0	2
Colorado:								
Denver.....	4	9	6	-----	0	2	2	4
Pueblo.....	2	1	0	-----	0	0	0	1
New Mexico:								
Albuquerque.....	0	0	0	-----	0	0	0	0
Arizona:								
Phoenix.....	0	0	0	-----	0	0	0	0

City reports for week ended September 26, 1931—Continued

Division, State, and city	Meningococcus meningitis		Lethargic encephalitis		Pellagra		Poliomyelitis (infantile paralysis)		
	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases, estimated expectancy	Cases	Deaths
WEST NORTH CENTRAL									
Minnesota:									
Duluth.....	0	0	0	0	0	0	0	4	0
Minneapolis.....	0	0	0	0	0	0	1	9	1
St. Paul.....	0	0	0	0	0	0	1	26	2
Iowa:									
Des Moines.....	0	0	0	0	0	0	1	2	0
North Dakota:									
Fargo.....	2	0	0	0	0	0	1	1	0
Nebraska:									
Omaha.....	0	0	0	0	0	0	1	1	0
SOUTH ATLANTIC ¹									
Maryland:									
Baltimore ¹	0	0	1	1	0	0	1	1	0
Cumberland.....	0	0	0	0	0	0	0	1	0
District of Columbia:									
Washington.....	1	0	0	0	0	0	0	2	1
West Virginia:									
Wheeling.....	0	0	0	0	0	0	0	1	0
North Carolina:									
Winston-Salem.....	0	1	0	0	1	1	0	0	0
South Carolina:									
Charleston.....	0	0	0	0	1	0	0	0	0
Georgia:									
Brunswick.....	0	0	0	0	0	1	0	0	0
Savannah ¹	0	0	0	0	2	0	0	0	0
EAST SOUTH CENTRAL									
Tennessee:									
Nashville.....	0	1	0	0	0	0	0	0	0
Alabama: ¹									
Birmingham.....	0	0	0	0	1	1	0	0	0
Mobile.....	0	0	0	0	0	1	0	0	0
WEST SOUTH CENTRAL									
Arkansas:									
Little Rock.....	0	1	0	0	0	1	0	0	0
Louisiana:									
New Orleans.....	1	0	0	0	0	0	0	0	0
Texas:									
Houston.....	0	0	0	1	0	0	0	0	0
MOUNTAIN									
Montana:									
Great Falls.....	0	0	0	0	0	0	1	1	0
Missoula.....	0	0	0	0	0	0	0	1	1
Utah:									
Salt Lake City.....	1	0	0	0	0	0	0	1	0
PACIFIC									
Washington:									
Seattle.....	0	0	0	0	0	0	0	1	0
Tacoma.....	0	0	0	0	0	0	1	1	0
California:									
Los Angeles.....	0	0	0	0	1	0	2	1	0
Sacramento.....	0	1	0	0	0	0	0	0	0
San Francisco.....	2	0	0	0	0	0	0	2	1

¹ Typhus fever, 6 cases: 1 case at Baltimore, Md.; 1 case at Savannah, Ga.; 2 cases at Tampa, Fla.; and 2 cases at Montgomery, Ala.

The following tables give the rates per 100,000 population for 98 cities for the 5-week period ended September 26, 1931, compared with those for a like period ended September 27, 1930. The population figures used in computing the rates are estimated mid-year populations for 1930 and 1931, respectively, derived from the 1930 census. The 98 cities reporting cases have an estimated aggregate population of more than 33,000,000. The 91 cities reporting deaths have more than 31,500,000 estimated population.

*Summary of weekly reports from cities, August 23 to September 26, 1931.—Annual rates per 100,000 population compared with rates for the corresponding period of 1930*¹

DIPHTHERIA CASE RATES

	Week ended—									
	Aug. 29, 1931	Aug. 30, 1930	Sept. 5, 1931	Sept. 6, 1930	Sept. 12, 1931	Sept. 13, 1930	Sept. 19, 1931	Sept. 20, 1930	Sept. 26, 1931	Sept. 27, 1930
98 cities.....	31	33	36	40	35	44	34	46	45	56
New England.....	41	53	55	39	58	60	36	34	38	56
Middle Atlantic.....	18	29	24	29	26	26	22	36	25	31
East North Central.....	33	45	38	48	32	63	29	74	42	74
West North Central.....	35	27	23	35	34	56	42	48	71	58
South Atlantic.....	63	64	34	66	45	68	73	46	67	100
East South Central.....	52	12	81	48	99	24	93	24	128	30
West South Central.....	34	66	105	56	41	45	52	63	101	136
Mountain.....	17	70	52	44	26	35	17	26	52	62
Pacific.....	24	17	27	32	29	22	29	12	41	26

MEASLES CASE RATES

98 cities.....	22	20	19	24	14	16	22	16	15	18
New England.....	63	22	58	36	29	41	31	19	31	46
Middle Atlantic.....	13	22	14	27	8	19	18	16	9	13
East North Central.....	23	7	11	12	13	9	17	14	16	13
West North Central.....	8	27	8	31	11	15	13	19	4	20
South Atlantic.....	4	32	8	28	6	6	14	22	8	10
East South Central.....	6	12	6	24	6	6	0	0	0	66
West South Central.....	24	10	10	0	10	3	20	0	3	10
Mountain.....	52	35	52	53	35	35	122	44	44	26
Pacific.....	53	30	67	34	45	16	53	18	51	16

SCARLET FEVER CASE RATES

98 cities.....	41	41	48	42	49	50	57	61	57	71
New England.....	46	56	87	60	106	56	87	77	53	87
Middle Atlantic.....	30	26	37	24	30	26	43	45	45	32
East North Central.....	43	47	56	47	64	84	62	90	62	117
West North Central.....	31	43	27	58	36	35	59	45	65	77
South Atlantic.....	30	72	51	72	55	56	71	44	67	62
East South Central.....	70	102	87	60	64	36	81	36	93	114
West South Central.....	64	14	54	63	41	24	52	52	34	52
Mountain.....	165	88	26	35	61	79	87	70	122	97
Pacific.....	39	26	43	28	39	63	55	67	71	75

¹ The figures given in this table are rates per 100,000 population, annual basis, and not the number of cases reported. Populations used are estimated as of July 1, 1931 and 1930, respectively.

² Terra Haute, Ind., not included.

³ San Antonio, Tex., not included.

Summary of weekly reports from cities, August 23 to September 26, 1931.—Annual rates per 100,000 population compared with rates for the corresponding period of 1930—Continued

SMALLPOX CASE RATES

	Week ended—									
	Aug. 23, 1931	Aug. 30, 1930	Sept. 5, 1931	Sept. 6, 1930	Sept. 12, 1931	Sept. 13, 1930	Sept. 19, 1931	Sept. 20, 1930	Sept. 26, 1931	Sept. 27, 1930
98 cities.....	1	2	1	3	1	3	1	4	0	3
New England.....	0	0	0	0	2	0	0	0	0	0
Middle Atlantic.....	0	0	0	0	6	0	0	0	0	0
East North Central.....	0	0	4	2	2	2	1	9	0	2
West North Central.....	4	8	4	14	6	27	0	21	6	14
South Atlantic.....	4	0	0	4	0	0	0	0	0	0
East South Central.....	0	0	0	0	6	0	0	0	0	0
West South Central.....	0	3	0	0	0	0	0	0	0	3
Mountain.....	0	0	0	0	0	0	0	0	0	0
Pacific.....	4	10	2	12	0	8	4	4	0	16

TYPHOID FEVER CASE RATES

98 cities.....	22	24	20	21	23	26	42	22	21	17
New England.....	22	12	7	12	7	22	22	12	5	12
Middle Atlantic.....	20	20	13	20	13	24	16	15	16	13
East North Central.....	10	10	16	12	10	17	91	11	15	9
West North Central.....	13	19	6	14	13	21	38	29	36	15
South Atlantic.....	38	88	49	58	79	70	26	68	43	56
East South Central.....	47	42	41	48	35	48	47	48	47	18
West South Central.....	96	66	74	45	91	52	48	63	47	35
Mountain.....	9	44	44	9	35	62	26	0	26	44
Pacific.....	12	8	10	8	27	4	35	14	10	12

INFLUENZA DEATH RATES

91 cities.....	2	4	2	3	4	3	3	3	2	2
New England.....	0	0	2	0	2	0	2	2	0	2
Middle Atlantic.....	2	3	1	3	4	4	3	2	1	2
East North Central.....	1	4	1	2	3	3	3	2	3	2
West North Central.....	3	3	3	6	9	0	6	0	0	0
South Atlantic.....	6	8	2	8	2	2	4	0	4	4
East South Central.....	13	6	6	0	0	19	0	26	6	13
West South Central.....	0	7	10	11	17	0	0	7	0	4
Mountain.....	0	0	0	9	0	0	0	18	0	0
Pacific.....	2	2	2	0	2	0	2	0	0	5

PNEUMONIA DEATH RATES

91 cities.....	48	52	50	53	55	54	59	57	52	57
New England.....	46	51	24	56	58	63	50	56	67	39
Middle Atlantic.....	60	57	62	65	65	63	66	65	55	72
East North Central.....	26	50	33	36	36	43	45	42	38	47
West North Central.....	50	39	62	51	44	45	44	75	44	36
South Atlantic.....	69	60	61	68	63	58	57	56	51	56
East South Central.....	57	45	38	91	82	26	57	71	32	65
West South Central.....	59	36	83	50	73	57	82	46	52	71
Mountain.....	61	53	96	53	70	123	78	115	70	53
Pacific.....	29	45	19	27	46	25	84	40	86	40

¹ Terre Haute, Ind., not included.

² San Antonio, Tex., not included.

FOREIGN AND INSULAR

MENINGITIS ON VESSEL

The steamship "President Wilson."—The steamship *President Wilson* arrived at San Francisco October 6, 1931, from Honolulu (September 30), with a history of meningitis on board. A steerage passenger developed meningitis the day following disembarkation at Honolulu, and a Chinese cook of the steerage galley died of the disease on September 12. The vessel sailed from Manila September 12, Hong Kong September 15, Shanghai September 18, Kobe September 25, and Yokohama September 23.

Contacts were detained at San Francisco quarantine, and cultures were made.

CANADA

Provinces—Communicable diseases—Week ended September 19, 1931.—The Department of Pensions and National Health of Canada reports cases of certain communicable diseases for the week ended September 19, 1931, as follows:

Province	Cerebro-spinal fever	Poliomy-elitis	Small-pox	Typhoid fever
Prince Edward Island ¹				4
Nova Scotia.....		1		10
New Brunswick.....				20
Quebec.....	1	73		20
Ontario.....	2	13		8
Manitoba.....			1	2
Saskatchewan.....		1	5	3
Alberta.....		1		3
British Columbia.....		3		75
Total.....	3	92	6	

¹ No case of any disease included in the table was reported during the week.

Quebec Province—Communicable diseases—Week ended September 19, 1931.—The Bureau of Health of the Province of Quebec, Canada, reports cases of certain communicable diseases for the week ended September 19, 1931, as follows:

Disease	Cases	Disease	Cases
Cerebrospinal meningitis.....	1	Poliomyelitis.....	73
Chicken pox.....	10	Puerperal fever.....	1
Diphtheria.....	31	Scarlet fever.....	31
Erysipelas.....	1	Tuberculosis.....	43
Gern an measles.....	6	Typhoid fever.....	20
Measles.....	12	Whooping cough.....	25
Mumps.....	6		

CZECHOSLOVAKIA

Communicable diseases—July, 1931.—During the month of July, 1931, certain communicable diseases were reported in Czechoslovakia, as follows:

Disease	Cases	Deaths	Disease	Cases	Deaths
Anthrax.....	15	—	Puerperal fever.....	44	15
Cerebrospinal meningitis.....	16	11	Scarlet fever.....	546	29
Diphtheria.....	1,077	51	Trachoma.....	232	—
Dysentery.....	102	3	Typhoid fever.....	501	21
Malaria.....	68	—	Typhus fever.....	1	—
Paratyphoid fever.....	25	1			

DENMARK

Communicable diseases—July, 1931.—During the month of July, 1931, cases of certain communicable diseases were reported in Denmark, as follows:

Disease	Cases	Disease	Cases
Anthrax.....	1	Mumps.....	210
Cerebrospinal meningitis.....	8	Paratyphoid fever.....	13
Chicken pox.....	5	Poliomyelitis.....	2
Diphtheria and croup.....	235	Puerperal fever.....	20
Erysipelas.....	212	Scabies.....	489
German measles.....	4	Scarlet fever.....	124
Gonorrhoea.....	911	Syphilis.....	111
Influenza.....	2,228	Tetanus.....	4
Lethargic encephalitis.....	5	Undulant fever (Bac. abort. Bang).....	46
Measles.....	2,146	Whooping cough.....	1,564

LATVIA

Communicable diseases—July, 1931.—During the month of July, 1931, cases of certain communicable diseases were reported in Latvia, as follows:

Disease	Cases	Disease	Cases
Botulism.....	2	Poliomyelitis.....	2
Cerebrospinal meningitis.....	6	Puerperal fever.....	15
Diphtheria.....	56	Scarlet fever.....	27
Erysipelas.....	35	Tetanus.....	3
Influenza.....	84	Trachoma.....	91
Lethargic encephalitis.....	1	Typhoid fever.....	103
Measles.....	23	Whooping cough.....	127
Mumps.....	28		

PORTO RICO

San Juan—Communicable diseases—Four weeks ended September 12, 1931.—During the four weeks ended September 12, 1931, cases of certain communicable diseases were reported in San Juan, Porto Rico, as follows:

Disease	Cases	Disease	Cases
Diphtheria.....	4	Measles.....	11
Leprosy.....	1	Typhoid fever.....	1
Malaria.....	70	Whooping cough.....	9

Place	Febru- ary, 1931		March, 1931		April, 1931		May, 1931			June, 1931			July, 1931			Aug. 1-10, 1931	
	1-10	11-20	1-10	11-20	1-10	11-20	1-10	11-20	21-31	1-10	11-20	21-30	1-10	11-20	21-31	1-10	11-31
Cebu.....																	
Iloilo.....			26		24												
Negres, Occidental.....			2		22												
Pampanga.....			1														
Stam.....	16	14	4	1	1	1											
Bangkok.....	4	5	2	1	1												
On vessels:	3	3	1	1													
S. S. Arankola at Rangoon from Calcutta.....		1															
S. S. City of Eastborne at Calcutta from Co- canada.....			1														
S. S. Tairea, at Penang from Calcutta.....																	
S. S. Bandar Shalpour, at Bushire, Persia, from Basra.....																	
S. S. Kohistan, at Basra from Bushire, Persia.....																	
S. S. Cathay at Kobe, Japan, from Shanghai.....																	
S. S. Kasagi Maru, at Moji from Shanghai.....																	
S. S. Ankoo, at Nagasaki from Shanghai.....																	
Indo-China (French) (see also table above):																	
Cambodia.....	C	125	100	113													
Cochin-China.....	D	80	99	170													
	C	28	105	107													
	D	18	73	74													

1 From May 3 to 25, 1931, 152 cases of cholera with 75 deaths were reported in Rafsanjan and vicinity, Karman district, Persia.

2 Figures for cholera in the Philippine Islands are subject to correction.

3 Reports incomplete.

Place	Mar., 1931	Apr., 1931	May, 1931	June, 1931	July, 1931	Aug., 1931	Place	Mar., 1931	Apr., 1931	May, 1931	June, 1931	July, 1931	Aug., 1931
British East Africa (see also table above):													
Kenya.....	7	345	245	154	484	197	Peru.....	8	8	2	5	2	
Indo-China (see also table above):	4	11	2	2	1		Senegal:	2	1		1		
Amboitra Province.....		2					Baoli.....			4			
Madagascar (see also table above):							Dakar.....			3			27
Amboitra Province.....	70	30	19	15	1		Louga.....			2			13
Antistrabe Province.....	86	29	18	15	1		Rufisque.....			3			88
Miarinarivo Province.....	83	48	7	12	13		Thies.....			1			144
Moramanga Province.....	74	47	7	12	12		Tivouane.....			4			106
Tananarive Province.....	19	6	2	2	8					1			2
	10	6	2	2	7					1			1
	1	1	2	1	1								2
	1	1	2	1	1								34
	90	41	18	10	5								26
	81	40	18	9	5								16

† Reports incomplete.

